Reducing Clients' Risk of Developing Future Cavities

Evaluation of an Expanded Fluoride Varnish Program

Evaluation Report
Southwestern Public Health
November 2018

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Acknowledgements

Thank you to Hilary Caldarelli, former Epidemiologist for Southwestern Public Health, for her contributions to the data collection and analysis phases of this evaluation. We would also like to thank the Oral Health team at Southwestern Public Health Woodstock site, Ruth Sanderson, the Community Research Ethics Office and Sonica Singhal for their helpful comments on and support of the data collection and analysis protocols. We are very grateful for the participation of our Community Dental Services clients in this evaluation. Finally, we would like to thank the reviewers of this report for their feedback:

- Melissa MacLeod, Epidemiologist, Southwestern Public Health
- Carolyn Richards, Manager, Southwestern Public Health
- Mary Van den Neucker, Manager, Southwestern Public Health
- Susan MacIsaac, Director, Southwestern Public Health
- David Smith, Director, Southwestern Public Health
- Donna Kemp, Communications Advisor, Strategic Communication and Engagement, Oxford County
- Cynthia St. John, Chief Executive Officer, Southwestern Public Health

How to cite this document:
Gibbs, L. Reducing clients' risk of developing future cavities: evaluation of an expanded fluoride varnish program. Woodstock, ON: Southwestern Public Health; 2018.

Contents

Summary

Public health units in Ontario are mandated to provide programs to improve the oral health of children and youth. In Oxford County, Southwestern Public Health (Public Health) operates a Community Dental Services Clinic providing preventive services, including fluoride varnish application. In September 2016, Public Health offered two additional applications per year to all dental services clients 17 years old and younger attending the Oxford County clinics.

To evaluate the uptake, implementation and effectiveness of this expanded fluoride varnish program, we used a prospective cohort study design. Clients self-selected into one of two groups: the expanded treatment group (i.e., clients who received three or four fluoride varnish treatments) and the usual care group (i.e., clients who received one or two fluoride varnish treatments). Clinical examination by staff and pre- and post-treatment client questionnaires were utilized to determine presence of visible cavities, cavity risk, and oral health behaviours. A staff questionnaire was also undertaken to identify barriers and facilitators to the program and the evaluation.

The evaluation had three main findings:

- Public Health can expect half of clients who express interest in the program to visit the clinic three or four times in one year.
- The expanded fluoride varnish program effectively reduces the risk of developing future cavities among clients who receive the intervention at least three times in one year. These clients were three times more likely to have reduced risk of developing future cavities than the usual care group. Clients aged 12 and under are likely to receive the most benefits from this expanded program.
- Staff are more likely to detect a new cavity among clients who attend the clinic three or four times in one year than clients who attend one or two times a year.

We recommend that Public Health continue to provide the expanded fluoride varnish program to clients aged 17 years and under, especially to children 12 years old and under. Public Health should also implement a quality improvement plan to address challenges with booking the fluoride varnish-only appointments.

Reducing Clients' Risk of Developing Future Cavities

Background

Public health units in Ontario are mandated to implement programming that supports improved oral health of children and youth under the Ontario Public Health Standards.[1] As part of this mandate, Southwestern Public Health (Public Health) provides dental services to Oxford County residents without dental insurance through the Community Dental Services Clinic in Woodstock and mobile dental clinics in Tillsonburg.[a] At these clinics, preventive services such as teeth cleaning, scaling, polishing, sealants, oral hygiene education and fluoride treatments are delivered by dental hygienists and dental assistants.[2] Restorative dental services, delivered by fee-for-service providers, are not provided by Public Health but are available to eligible children through the Healthy Smiles Ontario program. The Healthy Smiles Ontario program reimburses community dental providers for delivering these services. Children receiving Temporary Care Assistance or Assistance for Children with Severe Disabilities and children or families receiving assistance through Ontario Works and the Ontario Disability Support Program are automatically enrolled in Healthy Smiles Ontario. If a child is not receiving these supports, the family must apply to the program. Program eligibility is assessed based on household income and the number of children in the household; for example, as of July 1, 2018 a family with four children must have a net income of $28,431 or lower to be eligible for the Healthy Smiles Ontario program.[3]

Population health interventions to prevent cavities and improve oral health include oral health screening, oral hygiene education, sealants, fluoridation of drinking water and topical fluoride applications. In accordance with the Oral Health Protocol, 2018, Public Health conducts oral

[a] Southwestern Public Health was created in May 2018 through the merger of two public health units: Oxford County Public Health and Elgin St. Thomas Public Health. Although the merged organization serves the residents of Oxford County, Elgin County and St. Thomas, this evaluation began prior to the merger and focuses only on services delivered in Oxford County.

health screening at local schools for students in junior kindergarten, senior kindergarten and grade two. Students in grades four, six and seven are screened based on the school's assessed screening intensity level.[4] Infants and toddlers can receive free screening at the Community Dental Services Clinic.

Public Health also provides oral hygiene education through its health promotion programming in schools and in the community during Oral Health Month each April; clients of the Community Dental Services Clinic and the mobile clinic receive oral hygiene education and a free oral health kit (including a toothbrush, floss and toothpaste) during each visit. Sealants are applied to the chewing surfaces of pre-molar and molar teeth to create a barrier between teeth and bacteria[5] and are effective at preventing pit and fissure cavities.[6] Public Health applies sealants to the teeth of children who attend the Community Dental Services Clinic and the mobile clinic.

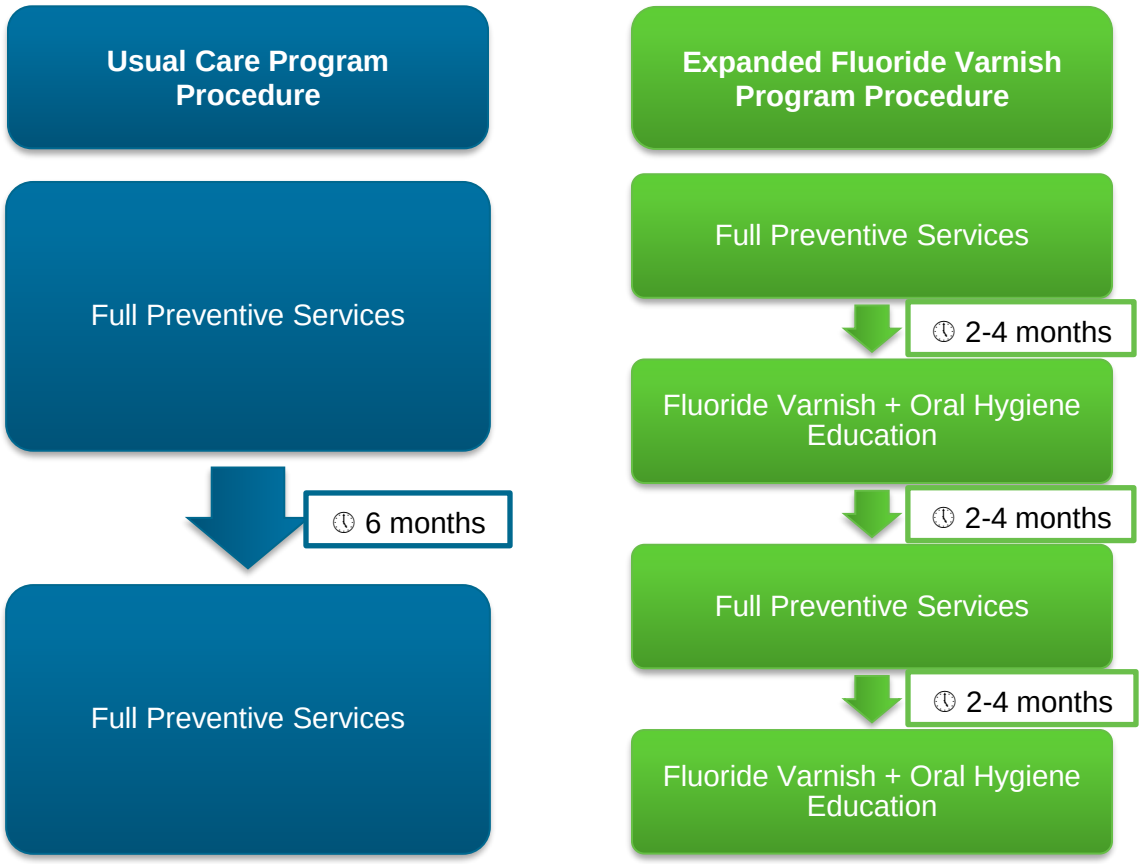
Fluoride is a mineral that naturally occurs in water, plants and soil; it is also added to dental products like toothpaste. Fluoride has demonstrated effectiveness in preventing cavities by preventing or slowing the loss of minerals in teeth, enhancing the remineralization of tooth enamel and constraining the activity of bacteria that cause cavities.[7] Although some municipalities in Ontario add fluoride to their drinking water systems, Oxford County does not add fluoride to the drinking water.[8] Topical fluoride can be delivered by way of a varnish: a sticky substance brushed directly onto teeth. The American Dental Association Center for Evidence-Based Dentistry recommends that children under age 18 at high risk of developing cavities receive fluoride varnish applications every 3 to 6 months.[7] Until September 2016, Public Health provided twice-yearly fluoride varnish applications to eligible children and youth attending the Community Dental Services Clinic (Woodstock) or the mobile clinic (Tillsonburg).

Expanded Fluoride Varnish Program

Beginning in September 2016, Public Health received provisional funding from the Ministry of Health and Long-Term Care to expand its fluoride varnish program. With this funding, Public Health offered four applications per year to all dental services clients 17 years old and younger as opposed to the usual two applications. Clients (through their guardians) were offered the option to attend the Woodstock or Tillsonburg clinic for two additional appointments per year. Two of the four appointments included provision of full preventive services as usual; between each appointment, clients could attend the clinic for a brief appointment consisting of only

fluoride varnish application and oral hygiene education; the intervention therefore consists of two components: fluoride varnish and education. Ideally, appointments would be spaced three months apart (Figure 1), but the treatment protocol allowed for visits to occur two to four months apart. If clients chose not to book or attend additional appointments, they continued to receive the same preventive services they had always received from the clinic.

Figure 1. Treatment schedules of the usual care and expanded fluoride varnish programs



Purpose and Research Questions

Public Health sought to evaluate the expansion of the fluoride varnish program to determine its feasibility and effectiveness and inform future service provision and budgeting. We focused our evaluation on three areas: uptake, implementation and effectiveness. Our research questions were:

1. What was the uptake of the expanded fluoride varnish program among Community Dental Services and mobile clinic clients aged 17 years and younger?
2. What barriers and facilitators to uptake were experienced by clients and their families?
3. What barriers and facilitators to implementation were experienced by Public Health staff?
4. How did the expanded fluoride varnish program affect clients' risk of developing future cavities and incidence of cavities?

Secondary research questions, indicators and data sources are listed in the evaluation matrix (Appendix A).

Methods

This evaluation capitalized on the planned implementation of an expanded fluoride varnish program in a public health dental clinic and took place from September 2016 to December 2017. The study was scheduled to last two years (until September 2018), but preliminary analyses revealed that additional data collection would not provide information that would change our conclusions, so we discontinued data collection in December 2017. We used a prospective cohort study design with self-selection to the intervention and compared two groups: the expanded treatment group (i.e., clients who received three or four fluoride varnish treatments) and the usual care group (i.e., clients who received one or two fluoride varnish treatments). All clients of the Community Dental Services clinic and mobile clinic aged 17 years old and younger were eligible to participate in the evaluation. The evaluation procedures were approved by the Community Research Ethics Office in July 2017 (Application #56).[9]

Participants

The primary research population was clients of Public Health's Community Dental Services Clinic and mobile clinic who were 17 years old or younger at the time of enrolment in the evaluation. We aimed to enroll at least 100 clients in the evaluation. All new and existing clients

aged 17 years old and younger were eligible to participate in the expanded fluoride varnish program and the evaluation. The program secretary informed clients and their parents/guardians of the expanded program and the evaluation at their first visit to the clinic following study commencement. Informed consent (from guardians and clients over 16 years old) and assent (from clients under 16 years old) was obtained for clients who agreed to participate in the evaluation. Clients could elect to receive the expanded fluoride varnish treatment without participating in the study. Consenting clients were assigned a participant ID code so that their data were not linked to their names.

All Public Health employees (i.e., managers and front-line staff) working in the Oral Health program (including the Community Dental Services clinic and/or the mobile clinic) were the secondary research population. All employees were eligible to participate but were not required to do so. Completion and submission of an online questionnaire indicated their assent to participate. Five employees completed the questionnaire.

In total, 588 clients consented to participate in the study. The final study population included 354 clients whose first visits were before March 1, 2017 and therefore could have completed four visits within the prescribed treatment protocol by December 1, 2017. We excluded 17 participants who did not receive fluoride varnish at each visit and one participant who did not complete a visit after enrolling in the study. The demographics of client participants at baseline are described in Appendix B.

Data Collection

Client data were collected by Public Health staff working in the Community Dental Services and mobile clinics. Client data were recorded on paper and entered in Microsoft Excel by the program secretaries. Data sources for this study population included electronic records, questionnaires and clinical examinations.

Client demographics, including age, gender and municipality of residence were retrieved from the clients' Dentrix client records (Public Health's electronic oral health record). Clients and guardians, where appropriate, were asked to complete two questionnaires (Appendix C), provided to them by a program secretary: baseline and follow-up (one year after their first visit after enrolment). The baseline questionnaire included questions about the client's oral health

behaviours. The follow-up questionnaire asked about the client's oral health behaviours, past year and intended future fluoride varnish visits, facilitators and barriers to visiting the clinic and preferences for clinic location and hours.

Following a clinical examination at each visit, the dental hygienist and/or dental assistant recorded the participant's risk of developing future cavities, the number of visible cavities and whether fluoride varnish was administered during the appointment (Appendix D). The risk of developing future cavities was categorized as high, moderate or low according to the criteria[b] described in Table 1.

Table 1. Criteria for assigning risk of developing future cavities

High	Moderate	Low
Any one of the following: • More than three cavities present at time of exam • Plaque index = 3 • No flossing • Less than daily brushing • Daily consumption of sugar sweetened beverages • Daily consumption of sugary treats • Current tobacco user	**Any of the following, with no items in the high risk category:** • Two to three cavities present or in past year • Plaque index = 2 • Infrequent flossing • Daily brushing • Weekly/occasional consumption of sugar sweetened beverages • Weekly/occasional consumption of sugary treats • Former tobacco user	**Any of the following, with no items in the high or moderate risk categories:** • One or fewer cavities in past year • Plaque index = 1 • Daily flossing • Brushing twice a day, everyday • No consumption of sugar sweetened beverages • No consumption of sugary treats • Never used tobacco

Public Health employees (including the Manager) who work in the Community Dental Services and mobile clinics were asked to complete a brief online questionnaire to understand the facilitators and barriers to implementing the expanded fluoride varnish program. The questionnaire also included questions about the facilitators and barriers to conducting this evaluation so that we could improve future evaluations. Employees received an email requesting their participation in the online questionnaire and reiterating the confidential and

[b] These criteria were developed by two dental hygienists, two dental assistants, a public health planner and an epidemiologist. They are based on published academic research, best practice guidelines and clinical experience.[10-12]

voluntary nature of the questionnaires. Completion of the questionnaire indicated assent to participate in the evaluation.

Data Analysis

Data analysis was conducted by a public health planner and an epidemiologist and included the use of descriptive and inferential statistics and qualitative thematic analysis. Descriptive analyses included participant demographics, the proportion of clients consenting to participate in the evaluation (a proxy for the proportion of clients interested in the expanded fluoride varnish program) and the proportion of participants who completed the protocol in the prescribed timeframe (i.e., received four fluoride varnish treatments in 8 to 10 months) and completed the protocol within 12 months. The frequency of responses to multiple choice questions in the baseline and follow-up questionnaires were calculated in Microsoft Excel. Open-ended questions were analyzed using simple qualitative thematic analysis.

Participants were divided into two groups based on the number of fluoride varnish treatments they received in one year: usual care (i.e., one or two treatments) and expanded treatment (i.e., three or four treatments). Chi-square tests for differences in proportions, two-sample t-tests and two-sample Wilcoxon rank-sum tests were performed in Stata (v.12.1)[13] to understand demographic and oral health status differences between the two groups at baseline. Wilcoxon signed-rank tests were conducted for the expanded treatment group members who completed both the baseline and follow-up questionnaires to compare changes in oral health behaviours. Adjusted relative risks (RR) with 95% confidence intervals (95% CI) were calculated in OpenEpi (version 3)[14] for each experimental group to determine the effect of the intervention on the participants' risk of developing future cavities and the incidence of new cavities, stratified by dentition.[c]

For future cavities risk level, a participant was considered to have the outcome of interest if their risk level at their final visit was lower than at their first visit; if a participant only had one visit, we assumed that their risk level stayed the same and therefore did not have the outcome of interest. For incidence of new cavities, participants who developed a new cavity during visits two

[c] We used age as a proxy for dentition, where primary dentition was defined as ages 0-5, mixed dentition was defined as ages 6-12 and permanent dentition was defined as ages 13-17.

to four were considered to have the outcome of interest; we assumed that participants who only had one visit did not have a new cavity and therefore did not have the outcome of interest.

Because public health programs and services rarely show measurable outcomes in each participant, it is important to understand how many participants need to be treated to see a benefit in one person. The number needed to treat (NNT) [d] is a way to understand how much effort is needed to see an effect in one person.[15] In this case, we wanted to know how many clients needed to receive at least three fluoride varnish treatments to see reduced risk of developing future cavities in one client or to see at least one new cavity in one client. The lower the NNT, the fewer resources that need to be invested to see a benefit of the treatment.

Results

Group Differences at Baseline

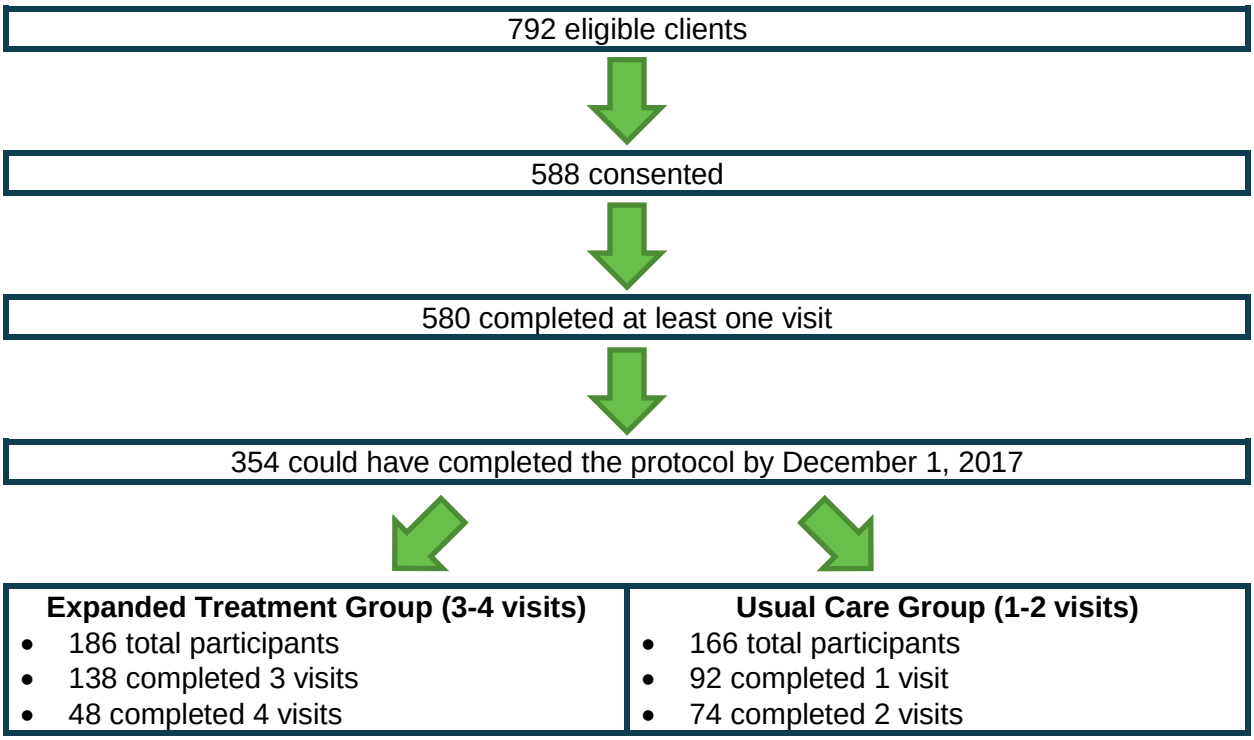
There was no difference between the expanded treatment and usual care groups in terms of sex, rural/urban residence or cavities risk at the first visit. However, there were differences in age and visible cavities at the first visit between groups. There were more young children in the expanded treatment group (mean age = 7.3 years) compared to the usual care group (mean age = 8.5 years; Appendix A). The expanded treatment group had fewer cavities (mean = 0.3 visible cavities) than the usual care group (mean = 0.6 visible cavities).

[d] The NNT is calculated using the reciprocal of the absolute risk difference (or absolute risk reduction) between the expanded treatment and usual care groups, then we round up to the nearest whole number to find the number of people we need to treat. For example, if 25% of the expanded treatment group and 42% of the usual care group had the outcome, NNT = 1/(0.42-0.25) = 1/0.17 = 5.88, or 6 people.[15]

Uptake

Of the 792 clients eligible to participate in the study, 588 (74.2%) consented (Figure 2). Of the 354 participants who could have completed the protocol before data collection ceased, 47 (13.3%) participants completed four visits in 8 to 10 months; one additional participant completed four visits in 12 months. The expanded treatment and usual care groups had similar numbers of participants: 186 (53.1%) and 166 (46.9%), respectively. Although there was significant interest in the expanded fluoride varnish treatments, about half of interested clients attended at least three visits in one year.

Figure 2. Uptake of the expanded fluoride varnish program

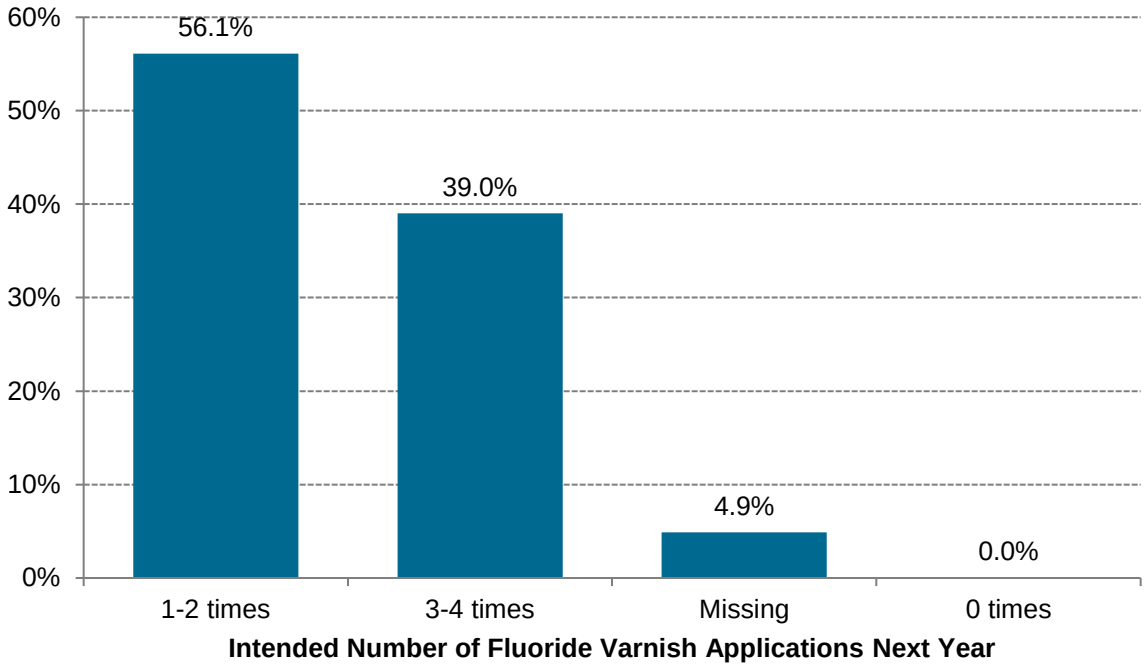


Implementation

Forty-one follow-up questionnaires were completed by clients and most of them (95.1%) said they liked coming in just for fluoride varnish applications. All but two respondents said they intended to get at least one fluoride varnish application in the next year, with 23 (56.1%)

intending to do so 1 or 2 times in the next year and 16 (39.0%) intending to do so 3 or 4 times in the next year (Figure 2).

Figure 3. How often respondents plan to get fluoride varnish applications in the next year

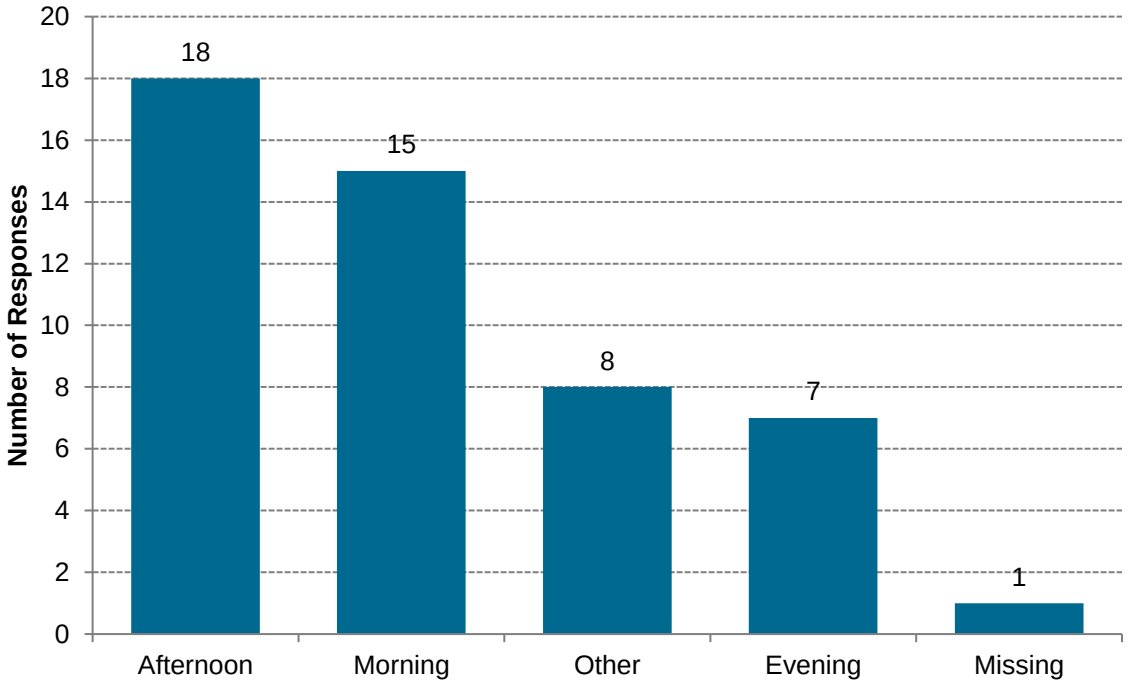


Thirty-four respondents (82.9%) to the follow-up questionnaire chose the current Woodstock location as their preferred location for the dental clinic and six (14.6%) chose Tillsonburg as their preferred location; one respondent left the question blank. Respondents reported few barriers to visiting the clinic, with 34 respondents (82.9%) indicating that it was not hard to get there. Four respondents said that not living in Woodstock made it difficult to get there, one said it was hard to get there by bus and one said they were busy. Clients' guardians reported the following reasons for cancelling scheduled appointments:

- not wanting to come to the clinic every three months
- getting sick after fluoride varnish applications
- not liking fluoride
- moving
- getting fluoride varnish applications elsewhere
- obtaining dental insurance
- being too busy

When asked what appointment times they prefer, client questionnaire respondents indicated that they prefer morning (15 responses) and afternoon (18 responses) appointment times; evening appointment times was chosen seven times. Of the eight respondents who chose "other," three prefer Saturday appointments, three prefer "anytime" and two prefer appointments on holidays (Figure 3). Respondents suggested that the clinic could be improved by making it available to adults, adding weekend hours and improving and increasing advertisements.

Figure 4. Respondents' appointment time preferences



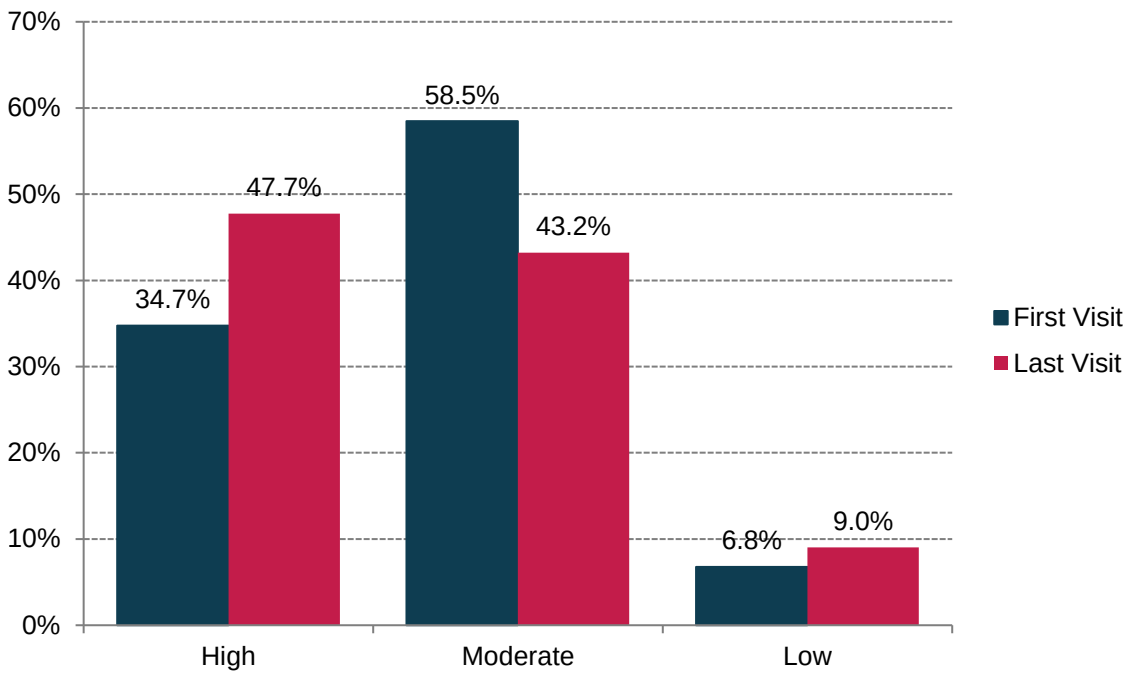
Five of eight Public Health employees (62.5%) responded to our questionnaire. The questionnaire asked them to identify barriers and facilitators to implementing the expanded fluoride varnish program with respect to the following implementation components: registration and scheduling, documentation, the treatment protocol and the evaluation protocol. Across the different implementation components, a common barrier was not having enough staff available to do the work; for example, one respondent identified that some of the expanded appointments were booked when there was only one dental team (i.e., one dental hygienist and one dental assistant) available, making it difficult for them to accommodate an increased number of clients. Employees also expressed concerns about the burden that the expanded fluoride varnish program and the evaluation imposed on clients. The tools used in and developed for the process – including Dentrix, the risk level criteria and spreadsheets – were listed as facilitators

in multiple components; however, suggestions were made for specific improvements to the criteria and spreadsheets. Staff also identified having an extra clinic room available and having fluoride varnish treatments scheduled at the same time as recall appointments as facilitators. To improve future implementation, staff suggested that the expanded appointments only be booked when two dental teams are in the clinic and to assign a dental assistant to the Tillsonburg mobile clinic once or twice a month to “free up” the mobile clinic. One respondent suggested that communication between staff needed to be improved to prevent double-bookings. Suggestions to improve future evaluation protocols were focused on simplifying the data collection for both staff and participants (e.g., reducing the number of questionnaires to one per family instead of one per child).

Impact

At both the first and last visits, most participants were classified as having high or moderate risk of developing future cavities (Figure 4). Forty-eight participants (25.8%) in the expanded treatment group and 14 participants (8.4%) in the usual care group were assessed as having a reduced risk of developing future cavities between their first and last visits.

Figure 5. Proportion of clients with high, moderate and low risk of developing future cavities at their first and last visits



After adjusting for dentition, participants in the expanded treatment group were three times more likely to have a reduced risk of developing future cavities than the usual care group (Table 1). To see reduced risk in one client, six clients would need to receive the intervention at least three times in one year (NNT = 5.8). The most marked difference was seen among participants with primary dentition (aged 0-5 years): expanded treatment group members with primary dentition were 6.5 times more likely to have reduced risk of developing future cavities than their usual care group counterparts (Table 2). Clients with mixed dentition (aged 6-12 years) in the expanded group were almost 3.5 times more likely to have reduced cavities risk than the usual care group, but clients with permanent dentition (aged 13-17 years) in the expanded treatment group did not show a significant reduction in risk compared to the usual care group.

Table 2. Reduced risk of developing future cavities, expanded treatment group vs. usual care group, stratified by age group (dentition)

Age Group (Dentition)	Relative Risk (95% CI)
0-5 years (Primary)	6.55 (2.09, 20.56)
6-12 years (Mixed)	3.44 (1.22, 9.64)
13-17 years (Permanent)	1.02 (0.33, 3.15)
Overall*	3.31 (1.80-6.09)

* - adjusted for dentition; CI = confidence interval

One hundred fifty-five participants (83.3%) in the expanded treatment group and 160 participants (96.4%) in the usual care group had at least one new cavity after their first visit. After adjusting for dentition, the expanded treatment group was 14% more likely than the usual care group to have a new cavity after their first visit (Table 3). This result is the opposite of what we expected but may reflect increased detection of cavities rather than the development of new cavities. The expanded treatment group, by definition, attended the clinic more frequently than the usual care group and therefore had more opportunity to have a cavity detected by staff. To detect a new cavity in one client, eight clients would need to receive the intervention at least three times one year (NNT = 7.17).

Table 3. Risk of having no new cavities after the first visit, expanded treatment group vs. usual care group, stratified by age group (dentition)

Age Group (Dentition)	Relative Risk (95% CI)
0-5 years (Primary)	0.86 (0.77, 0.96)
6-12 years (Mixed)	0.80 (0.72, 0.89)
13-17 years (Permanent)	1.01 (0.87, 1.18)
Overall*	0.86 (0.80, 0.92)

* - adjusted for dentition; CI = confidence interval

Forty-one participants completed both a baseline and follow-up questionnaire and all were in the expanded treatment group. Of those participants who completed the questionnaires, 15% reported increased frequency of brushing, 24% reported increased frequency of flossing, 15% reported reduced consumption of sugary snacks and 34% reported reduced consumption of

sugary drinks. We could not detect statistical significance for these results due to the low number of completed follow-up questionnaires, but it is also possible that a true difference did not exist.

Limitations

This study's measures of visible cavities were observational and did not include x-ray imaging; as such, early stage cavities may not have been detected and the true prevalence and incidence of cavities may be underestimated. Similarly, measures of enamel strength beyond visible cavities were not included in this study, so we cannot make conclusions about the effect of the fluoride varnish on remineralization of enamel.

The criteria used to determine risk of developing future cavities was developed by Public Health staff using published literature and clinical experience. Several of these criteria rely on the patient self-reports of behaviour, which may be subject to social desirability bias and may underestimate the participants' true risk. Similarly, few follow-up questionnaires detailing participants' oral health behaviours were received, so it was difficult to make conclusions about changes in behaviour (e.g., brushing and flossing frequency) between the baseline and follow-up questionnaires.

The expanded treatment group, in self-selecting to attend more visits to the clinic, also had more contact with oral health providers and more frequent opportunity to receive oral hygiene education and resources (e.g., toothbrushes) than the usual care group. This group also had a lower mean age than the usual care group, which may signal that these participants were more likely to engage in oral hygiene behaviours and attend dental visits as older children are less often supervised during toothbrushing and flossing routines. Therefore, the effect we saw on risk of developing future cavities may have been positively influenced by these differences. Conversely, by attending more dental visits than the usual care group, participants in the expanded treatment group had more opportunity to have a cavity detected. The increased likelihood of the expanded treatment group to have a new cavity may reflect this increased detection, rather than an actual increase in new cavities.

Finally, the relatively few barriers to attending the Community Dental Services Clinic for additional fluoride varnish applications identified by participants may not accurately represent all

clients' – or potential clients' – experiences. Clients who responded to the questionnaire were already attending the clinic more often and therefore may experience fewer barriers than those who did not respond or those who were in the usual care group. As a result, the barriers may be underestimated and future investigation into the potential barriers to attending the clinic that current and potential clients face is needed.

Discussion

Clinical guidelines recommend topical fluoride varnish applications every three to six months for children 18 years and younger who are at high risk for developing cavities.[7] This evaluation's findings align with the guidelines and support applications of fluoride varnish and oral hygiene education every three to four months. Community Dental Services clients who attended three or four appointments in a year were more likely to be assessed as having reduced risk of developing future cavities than those who attended fewer appointments – especially among clients 12 years old and younger. By attending the Community Dental Services clinic more often than they had previously been able, this expanded treatment group had a greater dosage of two interventions than they had in the past: fluoride varnish and oral hygiene education. As most of our risk criteria focus on oral health behaviours, the reduced risk seen in this evaluation may be a result of more frequent contact with dental health professionals and more frequent exposure to oral hygiene education rather than because of the varnish. We cannot distinguish between the effect of the fluoride varnish and the effect of oral hygiene education on the clients' risk of developing future cavities because we only assessed the effect of providing both the intervention components at each additional appointment. Regardless of how the clients' risk was reduced, this evaluation supports more frequent appointment schedules for children aged 17 years and younger.

A systematic review of the effect of fluoride varnish treatment on the oral health of children found that it is effective at preventing cavities. After combining data from over 20 studies, the authors found that fluoride varnish can provide a 43% reduction in DMFS scores[e] in permanent

[e] The DMFS/dmfs score is equal to the number of decayed, missing or filled tooth surfaces. The use of capital letters indicates permanent dentition; lowercase letters indicate primary dentition.

teeth and 37% reduction in dmfs scores in primary teeth.[16] These results differ from our evaluation which showed that clients who participated in the expanded fluoride varnish program were *more* likely to have a visible cavity than those who participated in our usual care program. However, these disparities may be attributed to differences in two things: follow-up periods and outcome measures. Over half of the studies included the systematic review had follow-up periods of two years[16] – one year longer than this evaluation. Because cavities take a long time to develop, our evaluation may not have been able to detect a reduction in cavities because our follow-up period did not last long enough. Similarly, by measuring only visible cavities – and not the number decayed surfaces as in the systematic review – we may have recorded "new" cavities at visits two to four that were in the early stages of development at the first visit but were not yet visible without more advanced diagnostic imaging (e.g., x-rays). Despite not seeing a reduction in cavities, the expanded fluoride varnish program led to increased detection of cavities among participants, thereby increasing the children's opportunities to receive dental treatment.

Increased cavity detection is particularly important to our client population, as the Community Dental Services Clinic targets clients who cannot afford private dental care and are often from low-income families. Public Health also facilitates the application process for the Healthy Smiles Ontario program which provides free cavity treatment – among other services – for eligible children and youth ages 17 years old and younger from low-income households.[3] By attending the Community Dental Services Clinic more often, clients are more likely to have cavities detected and receive free treatment earlier than if they attended only twice a year. Additionally, clients who cannot afford to purchase new toothbrushes and dental floss at regular intervals may also be better able to engage in oral health-promoting behaviours because clients are provided with oral hygiene education and resources (e.g., toothpaste, toothbrushes and floss) at each appointment. The expanded fluoride varnish program, therefore, may contribute to reducing oral health inequities between the highest and lowest income groups over time.

Our data show that there is likely significant interest in additional fluoride varnish applications and about half of interested clients will attend three or more times a year; about 13% can be expected to attend four sessions a year. These small increases were handled well by clinic staff, particularly when two teams of staff were available to provide the intervention. Some public health units in Ontario deliver fluoride varnish applications in preschools and elementary schools and have reported reductions in tooth decay among children receiving applications in these settings.[17,18] Despite our participants citing few barriers to attending the clinic, this setting

may pose barriers that prevent people from attending in the first place and therefore may not have the opportunity to participate in the expanded fluoride varnish program. Fluoride varnish applications in community settings may reduce these barriers. Interventions in community settings may reach more children, but they can also increase mileage and related personnel costs to the health unit. In contrast, the targeted universalism approach used in our clinic-based intervention did not increase personnel costs because the staff were already scheduled to work during the expanded fluoride varnish appointment times. Additionally, more resources are spent on clients with greater need than on those children who may already have access to dental care and fluoride varnish applications. Although both approaches appear to be effective, budget constraints may favour providing fluoride varnish applications in the clinic over community settings.

Conclusions

Overall, the findings demonstrate that the expanded fluoride varnish program effectively reduces the risk of developing future cavities among clients who receive the intervention at least three times in one year. Clients aged 0 to 12 are most likely to receive benefits from this expanded program. The program may also increase the detection of new cavities among participants, which provides more opportunities for clients and their guardians to address tooth decay. The expanded program has the potential for significant uptake; based on the participation rates in this study, Public Health can expect half of clients who express interest in the program to visit the clinic three or four times in one year. The program poses few barriers to participation to existing clients, but it may not address the barriers that currently exist for community members not currently attending the clinic. Additional research is necessary to determine what these barriers are for this population and how to overcome them.

Recommendations

Based on the findings from this evaluation, we recommend Public Health:

1. continue providing the expanded fluoride varnish program – including both fluoride varnish application and oral hygiene education – to clients aged 17 years and under, with a focus on children with primary and mixed dentition
2. implement a quality improvement plan to address challenges with booking the fluoride varnish-only appointments

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Appendix A – Evaluation Matrix

Question	Indicators	Data Sources	Timeline
1. Uptake			
1a. To what extent did our target audience consent to receiving fluoride varnish?	% of eligible clients who consented to evaluation	Excel tracking sheet Dentrix	1st visit
1b. To what extent did those who consented complete the protocol?	% of clients who consented that completed all treatments within the prescribed timeframes	Excel tracking sheet	1st visit
1c. What differences exist between the treatment and usual care groups?	Differences in: - Age - Gender - Municipality of residence - Cavities risk level at 1st visit - Presence of visible cavities at 1st visit	Excel tracking sheet	1st visit
2. Implementation			
2a. What facilitators and barriers to participating in the fluoride varnish program were experienced by clients?	# of times they plan to get fluoride treatments in next year % who liked coming in just for fluoride Reasons for not liking "fluoride only" appointments Reasons it is difficult to visit the clinic Reasons for cancelling appointments	Client questionnaire Excel tracking sheet	1 year after first visit

Question	Indicators	Data Sources	Timeline
2b. How should clinic policies and procedures be changed to improve clients' experiences?	Preferences for appointment times and clinic location Suggestions to improve clinic experience	Client questionnaire	1 year after first visit
2c. What facilitators and barriers to implementing the program were experienced by program staff?	Facilitators and barriers identified by staff related to: - Documentation - Registration - Treatment protocol - Evaluation protocol - Other	Staff questionnaire	September 2017
2d. How should program policies, processes, and procedures be altered to improve fidelity among program staff?	Changes suggested by program staff	Staff questionnaire	September 2017
3. Impact			
3a. How did the fluoride varnish treatments affect risk factors for cavities among participants?	# of clients who exhibit the following behaviours daily (start vs. end): - Brushing - Flossing - Sipping sugar-sweetened beverages - Snacking on sugary treats	Client questionnaire	1st visit and 1 year later
3b. How did the fluoride varnish treatments affect the clients' risk of developing future cavities?	Relative risk Number Needed to Treat % of clients in each risk category	Visit Card Excel tracking sheet	Every visit

Question	Indicators	Data Sources	Timeline
3c. How did the fluoride varnish treatments affect the incidence of cavities among participants?	Mean # of cavities per client at start vs. end Statistical difference in # of cavities between treatment and usual care group	Visit Card Excel tracking sheet	1st visit and 1 year later

Appendix B – Baseline Participant Demographics

Characteristic	Overall	Expanded Treatment Group	Usual Care Group
Sex, n (%)			
Male	160 (45.2)	86 (45.7)	74 (44.6)
Female	194 (54.8)	102 (54.3)	92 (55.4)
Age, mean (SD)*	7.9 years (4.4)	7.3 years (3.9)	8.5 years (4.7)
Residence, n (%)			
Blandford-Blenheim	15 (4.2)	8 (4.3)	7 (4.2)
East Zorra-Tavistock	10 (2.8)	3 (1.6)	7 (4.2)
Ingersoll	27 (7.6)	10 (5.3)	17 (10.2)
Norwich	83 (23.5)	39 (20.7)	44 (26.5)
South-West Oxford	21 (5.9)	12 (6.4)	9 (5.4)
Tillsonburg	40 (11.3)	19 (10.1)	21 (12.7)
Woodstock	144 (40.7)	87 (46.3)	57 (34.3)
Zorra	14 (4.0)	10 (5.3)	4 (2.4)
Dentition, n (%)			
Primary (0-5 years)	125 (35.3)	70 (37.2)	55 (33.1)
Mixed (6-12 years)	162 (45.8)	94 (50.0)	68 (41.0)
Permanent (13-17 years)	67 (18.9)	24 (12.8)	43 (25.9)
Number of visible cavities, mean (SD)*	0.4 (1.0)	0.3 (0.8)	0.6 (1.1)

* = significant difference between expanded treatment and usual care groups using independent samples t-test.
Age: t(352)=2.497, p=0.013; **Visible cavities:** t(352)=2.862, p=0.005; SD = standard deviation

Appendix C – Questionnaires

Client Questionnaire – Baseline

Participant ID: _____

1. How often do you **brush your teeth**?
    a. Never
    b. A few times a month
    c. A few times a week
    d. 1 time a day
    e. 2 times or more a day
2. How often do you **floss**?
    a. Never
    b. A few times a month
    c. A few times a week
    d. 1 time a day
    e. 2 times or more a day
3. How often do you eat sugary snacks like chocolate, candy and ice cream?
    a. Never
    b. Only on special occasions like birthday parties
    c. A few times a month
    d. A few times a week
    e. Every day
4. How often do you drink sugary drinks like pop, slushies and juice?
    a. Never
    b. Only on special occasions like birthday parties
    c. A few times a month
    d. A few times a week
    e. Every day

Client Questionnaire – Follow-Up

Participant ID: _____

1. How often do you **brush your teeth**?
    a. Never
    b. A few times a month
    c. A few times a week
    d. 1 time a day
    e. 2 times or more a day
2. How often do you **floss**?
    a. Never
    b. A few times a month
    c. A few times a week
    d. 1 time a day
    e. 2 times or more a day
3. How often do you eat sugary snacks like chocolate, candy and ice cream?
    a. Never
    b. Only on special occasions like birthday parties
    c. A few times a month
    d. A few times a week
    e. Every day
4. How often do you drink sugary drinks like pop, slushies and juice?
    a. Never
    b. Only on special occasions like birthday parties
    c. A few times a month
    d. A few times a week
    e. Every day
5. How many times did you come to the clinic **for fluoride in the last year**?
    a. 0 times
    b. 1-2 times
    c. 3-4 times
6. How many times do you think you will come to the clinic **for fluoride in the next year**?
    a. 0 times

b. 1-2 times
c. 3-4 times

7. Did you like coming in just for fluoride?
    a. Yes
    b. No → Why not?
8. What makes it **hard for you to visit the clinic**? (Circle all the reasons it's hard)
    a. It's hard to get there by car
    b. It's hard to get there by bus
    c. I don't live in Woodstock
    d. It's hard to go during the day
    e. Other:
9. What is the **best time** for you to come to the clinic?
    a. Morning
    b. Afternoon
    c. Evening
    d. Saturday
    e. Other:
10. Where is the **best place** for a dental clinic?
    a. Where it is now
    b. Somewhere else in Woodstock
    c. Tillsonburg
    d. Ingersoll
    e. Other:
11. How can we make our dental clinic better?

Staff Questionnaire

1. With respect to the **scheduling process** for fluoride varnish appointments, what made it **easy** for you to do your job?
2. With respect to the **scheduling process** for fluoride varnish appointments, what made it **hard** for you to do your job?
3. With respect to the **documentation process** for fluoride varnish appointments, what made it **easy** for you to do your job?
4. With respect to the **documentation process** for fluoride varnish appointments, what made it **hard** for you to do your job?
5. With respect to the **treatment protocol** for fluoride varnish appointments, what made it **easy** for you to do your job?
6. With respect to the **treatment protocol** for fluoride varnish appointments, what made it **hard** for you to do your job?
7. With respect to the **evaluation protocol** for fluoride varnish appointments, what made it **easy** for you to do your job?
8. With respect to the **evaluation protocol** for fluoride varnish appointments, what made it **hard** for you to do your job?
9. How can we improve the fluoride varnish appointment process in the future?
10. How can we **improve the evaluation process** in the future? (Note: Think about evaluation in general, not just this one)
11. Is there anything else you would like to share about your experience with the expanded fluoride varnish program and the evaluation?

Appendix D – Clinical Examination Visit Card

Visit Card

Participant ID: _____ **Date of Visit:** _____

Number of Visible Cavities: _____ **Fluoride Varnish Administered?** Yes ☐ No ☐

Risk of Developing Future Cavities: High ☐ Moderate ☐ Low ☐

Date Entered into Excel: _____

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