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Feasibility of Collecting Saliva for Biological Verification of Tobacco Use Status in Dental Practices and Patients' Homes: Results from the National Dental PBRN

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Objective: To evaluate the feasibility of collecting and analyzing saliva samples from dental practices and patients' homes for biochemical verification of tobacco use status. ***Basic research design:*** Sub-study within single-arm, multi-center, longitudinal clinical study. ***Clinical setting:*** Dental practices in the South Central region of the United States National Dental Practice-Based Research Network and patients' homes. ***Participants:*** Fifty-five patients recruited from 30 dental practices. ***Interventions:*** Participants in the sub-study were instructed on saliva collection for cotinine analysis in dental practices where they enrolled in the primary study. Saliva was collected at the practices and then from patients' homes. ***Main outcome measures:*** Feasibility for dental practice collection was define as 80% of enrolled participants having analyzable samples. For patients' home collection, feasibility was defined as 70%. ***Results:*** Forty-seven samples (i.e., 86% of those enrolled) collected in dental practices were analyzable. Twenty-one samples (i.e. 38% of those enrolled) collected in patients' homes were analyzable. ***Conclusions:*** Collecting saliva samples for cotinine analysis from dental practices, but not from patients' homes, was feasible. Dental practices may provide an advantageous setting for biochemically verifying tobacco use status as part of clinical trials for tobacco cessation.

Keywords: *Smoking cessation; saliva; cotinine; feasibility; dental practice*

Introduction

Tobacco use continues to be a leading preventable cause of death worldwide and has substantial negative effects on oral health (US Department of Health and Human Services, 2014; World Health Organization, 2017). Given the consequences for oral health, dental practices can serve as sites to deliver tobacco cessation interventions (Needleman *et al*., 2006), a practice recommended by the Treating Tobacco Use and Dependence Clinical Practice Guide (Fiore *et al*., 2008), the American Dental Association (American Dental Association House of Delegates, 2016) and the World Health Organization (Peterson, 2003). Dental professionals often have repeated visits with patients over time in which preventive health messages can be incorporated (Gordon *et al*., 2006).

Although the dental setting may be an important location for tobacco cessation services, it is a largely untapped resource (Gordon *et al*., 2006). Point-of-care tools may increase provision of tobacco cessation interventions by providing specific support and prompting providers to deliver guideline-consistent counseling. Point-of-care tobacco cessation tools using computers or mobile devices have been developed for the medical environment, but fewer target the dental practice. Such tools may be feasible (Montini *et al*., 2013) and increase the delivery of tobacco cessation counseling (Rindal *et al*., 2013).

QuitAdvisorDDS (QA-DDS) is a web-based point-of-care tool for dental practices that consists of a targeted and tailored interviewing guide for tobacco-related patient discussions as well as informational resources regarding evidence-based tobacco cessation practices. The feasibility of using QA-DDS was recently assessed in a clinical trial (NCT#02570646) within the National Dental Practice-Based Research Network (PBRN; Gilbert *et al*., 2013). As part of that trial, we assessed the feasibility of biochemically verifying tobacco use through saliva cotinine levels for a sub-set of participants. This sub-study was conducted due to the expectation that the effectiveness of tobacco cessation interventions is verified collaterally using a biomarker (Cha *et al*., 2017; Melvin *et al*., 2000; Murray *et al*., 1987; SRNT Subcommittee on Biochemical Verification, 2002). The aim of this study was to assess whether sample collection from both settings dental practices and patients' homes would be feasible.

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Method

Participants were recruited from January through August 2016 using convenience sampling from the larger QA-DDS trial. To be eligible, participants had to be receiving care from an eligible practitioner within the network, be aged 18 or older, self-report current tobacco use, agree to adhere to study procedures, be available for the duration of the study, be willing to be contacted by Regional Coordinators, provide contact information for one other person for location purposes, and not exhibit signs of xerostomia. Participants with conditions that would interfere with capacity to consent were excluded. Sixty participants, approximately two per participating practice, were targeted for recruitment in this sub-study.

Dental practice staff were trained on the study protocol and saliva collection procedures by network Regional Coordinators. After obtaining informed consent, dental practice staff collected an initial saliva sample with a Salivette® device. Collection procedures required participants to place an absorbent swab in their mouths and hold it there until they felt they could no longer prevent themselves from swallowing saliva produced (approximately 30-40 seconds). Saliva samples were labeled and shipped by practice staff to J2Labs (Tucson, AZ) for determination of saliva cotinine levels using immunoassay. At their 1-month follow-up, participants received a specimen collection kit by mail that contained detailed instructions regarding sample collection, a Salivette® device, and mailing materials. After collecting the saliva sample, participants were asked to mail it to J2Labs using the materials provided. To facilitate return of the samples, participants received the initial mailing of instructions and materials via US mail, and then courier overnight shipping was used to deliver samples to J2Labs. Participants who did not return the samples within 14 days received a reminder via their preferred method of contact (e.g., email or telephone). An additional reminder was mailed after 21 days of non-response. Finally, non-responding participants were mailed a final reminder letter and an additional saliva collection kit if the sample was not received within 30 days.

Consistent with recommended methods for conducting and analyzing pilot studies (Leon *et al*., 2011; Thabane *et al.*, 2010), the primary outcome was feasibility of saliva sample collection, defined *a priori* as dental practice staff collecting and mailing sufficient samples for 80% of enrolled participants and as 70% of participants collecting and mailing sufficient samples for testing from their homes. Participating patients received $20 for providing a practice-based sample and returning a sample to J2Labs, for a maximum total payment of $40.

Demographic and tobacco use data were summarised using descriptive statistics. Feasibility was evaluated based on percentages of usable saliva samples collected in the practice and at home (valid and non-missing). Independent sample *t*-tests (continuous variables) or chi-square (dichotomous variables) were used to compare individuals with and without an analyzable practice and home sample. Sample cotinine levels were analyzed using immunoassay and coded as positive for recent tobacco use (i.e., above 35 ng/ml) or negative for recent tobacco use (i.e., equal to or below 35 ng/ml). This cutoff point was based on the established immunoassay levels from the analyzing laboratory, although it is higher than recommended by experts (SRNT Subcommittee on Biochemical Verification, 2002). All tests were conducted using SPSS 24 with $p<0.05$.

The institutions' and network's applicable Institutional Review Boards approved the study.

Results

Participants and Accrual Feasibility

Fifty-five participants were enrolled in the sub-study. Demographic and tobacco use characteristics are shown in Table 1. Twenty-six of the 30 participating sites enrolled the desired 2 participants, 3 sites enrolled 1 and 1 did not accrue any. Ninety-two percent of the accrual goal was met.

Feasibility and Patient-Level Predictors

Forty-seven samples (86% of those enrolled) collected from dental practices were analyzable. The remaining samples could not be analyzed due to insufficient saliva (n=7) or being missing (n=1). Twenty-one samples (38% of those enrolled) collected from patients' homes were analyzable. The remainder were largely missing (n=32), but 2 samples were insufficient for analysis.

Cotinine Levels

Forty-six samples (98% of analyzable samples) collected from dental practices were positive for recent tobacco use. Twenty samples (95%) collected from patients' homes were positive for recent tobacco use.

Patient-Level Predictors of Sample Collection

None of the patient-level variables, including age, sex, race, education level, marital status, employment status, combustible cigarette use, or cigarettes per day, were significantly different between participants providing an analyzable sample at the dental practice or home.

Table 1. Participant Demographics (n = 55)

	Mean(SD)/%
Age	47.2 (14.0)
Sex	
Male	40%
Female	60%
Race/Ethnicity	
White	78.2%
African American	21.8%
College Education	47.3%
Living with Partner	58.2%
Unemployed	12.7%
State Residence	
Alabama	60.0%
Tennessee	14.5%
West Virginia	9.1%
Louisiana	5.5%
Mississippi	5.5%
Missouri	3.6%
Georgia	1.8%
Tobacco Use	
Cigarette Use	89.1%
Cigarettes/day	16.3 (11.3)
Smokeless Use	30.9%

Discussion

Sample collection and analysis rates from dental practices, but not from patients' homes, met the *a priori* definitions of feasibility. For non-analyzable samples, dental practices had proportionately more insufficient samples whereas samples from patients' homes were generally not mailed to the laboratory. Collection of saliva specimens from dental practices for biochemical verification of tobacco use status is feasible, although it may be necessary to advise staff on the appropriate

sample volume. If appropriate sample volumes can be collected, dental practices may be advantageous locations where biological samples can be collected before and after delivery of an intervention when patients have regularly scheduled visits.

The findings do not support the feasibility of saliva collection from patients' homes. In a previous study addressing the feasibility of biochemical verification of smoking status, 71% of individuals who had completed an online tobacco cessation intervention mailed a saliva sample for cotinine analysis (Cha *et al*., 2017). The reasons for the discrepancy between that study and ours are not known, but could be explained by the previous study receiving mailed samples from an adherent group of patients who reported that they met smoking abstinence point prevalence criteria.

It is also possible that our financial incentive (i.e., $20) was not sufficient to encourage sample submission. Because more money would likely be necessary to increase the response rate from patients' homes, other alternatives for verifying tobacco use status need to be considered. These could include information provided by spouses or proxies (Cha *et al*., 2017) or the use of a bogus pipeline (Murray *et al*., 1987). The cost of analysis and relatively low response rates indicate that it may not be advisable to require biochemical verification, especially in low-demand cessation trials or large population-based studies (SRNT Subcommittee on Biochemical Verification, 2002).

Limitations of the present study included: 1) a relatively small sample, which limited the power to identify predictors, and the sample was drawn from practice sites within a single region of the National Dental PBRN using convenience sampling, which could impact the generalizability of the results and 2) the lack of qualitative data from practitioners and patients to identify potential explanations for not providing analyzable samples. We also did not collect data regarding oral health status, with the exception of ruling out xerostomia at the time of enrollment, and did not include a non-tobacco using group to demonstrate the sensitivity, specificity and predictive values of the cotinine assessment.

Conclusion

This study fulfilled the aim of assessing the feasibility of saliva sample collection from dental practices and patients' homes, demonstrating feasibility in dental practices but failing to achieve the feasibility criterion for home-based collection by patients. Due to the serious effects of tobacco use on oral and general health, the dental setting may be an advantageous environment for collecting such samples in the context of a tobacco cessation intervention.

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References

American Dental Association House of Delegates (2016): *Policies and recommendations on tobacco use: Dentist's role in preventing tobacco use.* [Internet]. Chicago, IL: American Dental Association; 2016 October [updated 24 February 2017; cited 18 September 2018]. http://www.ada.org/en/about-the-ada/ada-positions-policies-and-statements/policies-and-recommendations-on-tobacco-use

Cha, S., Ganz, O., Cohn, A.M., Ehlke, S.J. and Graham, A.L. (2017): Feasibility of biochemical verification in a web-based smoking cessation study. *Addictive Behav*ior **73**, 204-208.

Fiore, M.C., Jaén, C.R., Baker, T.B. *et al*., (2008): *Treating tobacco use and dependence: 2008 Update.* 276 p. Rockville, MD: US Department of Health and Human Services, Public Health Service.

Gilbert, G.H., Williams, O.D., Korelitz, J.J., Fellow, J.L., Gordan, V.V., Makhjia, S.K., Meyerowitz, C., Oates, T.W., Rindal, D.B., Benjamin, P.L. and Foy, P.J. (National Dental PBRN Collaborative Group) (2013): Purpose, structure, and function of the United States National Dental Practice-Based Research Network. *Journal of Dentistry* **41**, 1051-1059.

Gordon, J.S., Lichtenstein, E., Severson, H.H., and Andrews, J.A. (2006): Tobacco cessation in dental settings: Research findings and future directions. *Drug and Alcohol Rev*iew **25**, 27-37.

Leon, A. C., Davis, L. L., & Kraemer, H. C. (2011). The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research, 45*(5), 626-629. doi:DOI 10.1016/j.jpsychires.2010.10.008

Melvin, C.L. and Tucker, P. (Smoke-Free Families Common Evaluation Measures for Pregnancy and Smoking Cessation Projects Working Group) (2009): Measurement and definition for smoking cessation intervention research: The smoke-free families experience. *Tobacco Control* **9 Suppl 3**, III87-90.

Montini, T., Schenkel, B., and Shelley, D.R. (2013): Feasibility of a computerized clinical decision support system for treating tobacco use in dental clinics. *Journal of Dental Education* **77**, 458-462.

Murray, D.M., O'Connell, C.M., Schmid, L.A. and Perry, C.L. (1987). The validity of smoking self-reports by adolescents: A reexamination of the bogus pipeline procedure. *Addictive Behavior* **12**, 7-15.

Needleman, I., Warnakulasuriya, S., Sutherland, G., Bornstein, M.M., Casals, E., Dietrich, T. and Suvan, J. (2006): Evaluation of tobacco use cessation (TUC) counselling in the dental office. *Oral Health and Preventive Dentistry* **4**, 27-47.

Peterson, P.E. (2003): Tobacco and Oral Health-The Role of the World Health Organization. *Oral Health and Preventive Dentistry* **1**, 309-315.

Rindal, D.B., Rush, W.A., Schleyer, T.K., Kirshner, M., Boyle, R.G., Thoele, M.J., Asche, S.E., Thyvalikakath, T., Spallek, H., Durand, E.C., Enstad, C.J. and Huntley, C.L. (2013). Computer-assisted guidance for dental office tobacco-cessation counseling: A randomized controlled trial. *American Journal of Preventive Medicine* **44**, 260-264.

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L. P. and Goldsmith, C. H. (2010). A tutorial on pilot studies: the what, why and how. *BMC: Medical Research Methodology, 10*. Doi 10.1186/1471-2288-10-1

SRNT Subcommittee on Biochemical Verification (2002): Biochemical verification of tobacco use and cessation. *Nicotine and Tobacco Res*earch **4**, 149-159.

US Department of Health and Human Services (2014): *The health consequences of smoking: 50 years of progress. A report of the Surgeon General.* 1081 p. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

World Health Organization (2017). W*HO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies.* 135 p. Geneva, Switzerland: World Health Organization.