Medication Discrepancies in the Dental Record: Implications on Oral Health

Hailey Choi, PharmD; Autumn Stewart, PharmD, BCACP

Introduction

Patients presenting for dental care frequently use medications with the potential for negative implications on oral health or the dental provider’s plan of care.1–5 Medications may affect oral health by causing orofacial effects (e.g., xerostomia, mouth ulceration, oral candidiasis, etc.).2,5 Medications can affect dental management as a result of direct effects of medications on parameters such as bleeding risk or drug-drug interactions with local anesthetics and vasoconstrictors.7,8 In addition, there are potential drug-drug interactions between medications taken by patients and those prescribed by a dental provider.2,9–13

In 1992, Miller and colleagues reported on findings from a retrospective chart review of over 5,000 patients from two dental school clinics in the United States. Over 40% of patients in this study were taking medications with the greatest use among the elderly, women, and blacks. The most common types of potential adverse effects of dental importance by medication use were xerostomia (15.8%), gastroesophageal irritation (12.9%), and abnormal bleeding (11.2%). The authors emphasize the need for dentists to be aware of not only the medications taken by their patients but also the potential effects and drug interactions that can result from their therapies.1 Similar findings were reported in a 2003 study from five general dental practices in England, where Brindley and colleagues found that over the course of a 5 month period, 26% of patients seen were taking systemic medications with a majority having the potential for significance to the dental provider’s plan either due to orofacial side effects caused by the medication or a potential interference with the dental management of the patient due to the medication itself.2

The research findings from Brindley and Miller emphasize the need for dentists to identify each medication and its potential effects or interference with the plan of care. However, each of these studies’ findings is limited by the presumed accuracy of the medication list in the dental chart or assessing prescription medications only. Little is known about discrepancies in medication lists in general dental practices or the clinical significance of those discrepancies on oral health and dental treatment procedures. Although patient medication histories are routinely gathered prior to the dental visit in most practices, observations from other outpatient care settings suggest the list generated in the dental provider’s office may contain incomplete and inaccurate medication lists.14–15 A 2007 study by Nassaralla et al reported only 7.7% of medication lists in an internal medicine outpatient clinic were accurate.14 Even with the use of electronic medical records, discrepancies persist at an alarming rate.15 Discrepancies between the list gathered in the dental provider’s office and the patient’s actual behaviors may lead to drug interactions, duplicate therapy, unnecessary therapy, or a failure to evaluate adverse oral effects caused by medications.

Given the amount of time since the previous studies were conducted and their limitations, a more accurate estimate of the current frequency of use of medications with potential negative implications on oral health is needed. Using models for medication reconciliation from other ambulatory care settings and adapting them for use in dental practices may provide a more complete medication list and thus, a more accurate estimate of the problem.
To respond to this need, phase 1 of the study was conducted to describe the frequency and clinical significance of medication discrepancies between the lists collected through usual care and medication reconciliation conducted by a clinical pharmacists, and phase 2 of the study was conducted to evaluate the impact of a pharmacist led training on dental professionals ability to obtain an accurate medication list.

**Methods**

This study is a prospective, case series study of adult patients receiving general dental care at a free health clinic for the uninsured in the urban Pittsburgh area. Phase 1 of the study was conducted to assess the baseline accuracy of medication reconciliation processes, and phase 2 of the study evaluated the impact of a pharmacist-led intervention to improve this process. The study was reviewed and approved by the Institutional Review Board at Duquesne University.

**Patient Enrollment**

Patients aged 18 to 80 years receiving only dental care at a free health clinic (Catholic Charities Free Health Care Center) were invited to participate in phase 1. Data collection for phase 1 occurred during the months of October 2014 to January 2015. The same inclusion criteria applied for patients in phase 2 with exclusions for those having already participated in phase 1. Data collection for phase 2 occurred between April and June 2015. The center provides free medical and dental care to uninsured adult patients with household incomes less than 200% of the Federal Poverty Level. Patients receiving medical care (in addition to dental care) at the clinic were excluded as medication reconciliation services are provided to these patients as part of usual care during medical appointments, and the medication list is updated in the Electronic Medical Record (EMR) at each visit. Dental providers at the clinic have access to the updated medication lists for medical patients. Because patients presenting for only dental services receive medical care elsewhere, the medication list is not immediately available and must be obtained through the dental provider and/or assistant. The decision to use “dental only” patients provides external validity to the study as in most dental practices the dentist would not have ready access to the EMR of the patients’ primary care provider. Subjects provided informed consent prior to participating in the study.

**Medication Review**

All dental patients continued to receive usual care by the dental assistant or providers for collecting medication lists. “Usual care” varied by assistant and provider but typically included asking the patient if there were any changes to their medications since last time or requesting the patient to fill out a history form with a section for medications. The assistant or provider then updated the patient’s record in the EMR. Following usual care, subjects were independently interviewed by a pharmacist for a medication review. The medication review included the names, doses, regimens, and indications of the medications being taken by the patient including prescriptions, over-the-counter (OTC) medications, and supplements. For patients unable to provide this information, the pharmacist contacted the patient’s community pharmacy. After completion of the medication review, the pharmacist compared the medication list collected via patient interview with the charted medications in the EMR. Discrepancies between the interview and chart were identified and classified by pre-defined types: not on medication, medication not on chart, similar medication/class, or different dose/sig. Although all four types of discrepancies
could be important clinically, a “medication not on chart” is likely most important for the purposes of this study. Patient use of medications in this category could occur unbeknownst to the dental provider and their implications not considered. Medication discrepancies of this type were further evaluated for potential clinical significance. Clinical significance was also pre-defined into categories including: oral adverse effects, local anesthetic/vasoconstrictor precautions, dental health professional considerations, effects on dental treatment, and effects on bleeding. A list of medications with reported oral manifestations was generated following a review of the literature.\textsuperscript{1-13} Each medication with a discrepancy was cross referenced with this list and also individually assessed in Dental Lexi-Drugs® to evaluate the medication’s potential impact on the dental provider’s plan of care.\textsuperscript{16}

\textit{Pharmacist-led intervention}

Following the phase 1 data collection, the preliminary study results were assessed, and a multi-faceted intervention by a pharmacist was implemented to improve the medication reconciliation process used by the dental providers. The intervention included a pharmacist-designed, interactive, software content object within the EMR to streamline and guide dental providers in the medication reconciliation process (Figure 1). The intervention also included a mandatory pharmacist-provided educational session on collecting and updating accurate medication lists during patient encounters. For those who could not make to the live educational session, the presentation content was recorded and disseminated to all dental providers. Following the intervention, the phase 2 data collection was conducted to evaluate the change in the frequency and types of discrepancies.

\textit{Statistical Analysis}

All data were collected using a data collection form adapted by the researchers from a previous study and entered into Microsoft Office Excel Spreadsheets.\textsuperscript{15} Descriptive statistics were used for all parameters and reported as mean (±SD) for normally distributed continuous variables. Medication discrepancies were quantified and classified by pre-defined types as described above. Statistical analysis compared patient demographics, number of medication discrepancies, number of medication discrepancies by type, and number of potential oral health implications by undocumented medications between phase 1 and 2. Chi-Squared Test, Fisher Exact Test, and Poisson Regression were used as appropriate to determine whether statistically significant differences existed between the phases. All analyses were conducted with the use of R statistical software, version 3.2.1. Two-sided P values of less than 0.05 were considered to be statistically significant.

\textbf{Results}

Frequency and clinical significance of medication discrepancies

\textit{Phase 1}

One hundred subjects participated in phase 1 for whom the demographic characteristics are summarized in Table 1. The mean age was 58 years old with 26\% over the age of 65. Ninety-seven percent of subjects reported the use of one or more medications with an average of 7.49 medications (prediction mean based on Poisson regression) per patient including prescription and OTC medications. Ninety-six percent of subjects had one or more discrepancies
present in the EMR with a mean of 6.35 discrepancies (SD, 2.52) per patient with a total of 618 discrepancies identified.

The most common type of discrepancy (71.7%) was medication not documented (Table 2). Of the 443 undocumented medications, 286 medications (64.6%) had at least one potential implication on oral health; these medications are listed by pharmacologic class in Table 3. These 286 medications had a combined total of 600 potential oral health implications. The types of oral health effects potentially caused by these medications are listed in Table 4 with the most common being xerostomia or dry mouth. Additionally, 7.9% of undocumented medications had potential interactions with local anesthetic/vasoconstrictors, and 19.2% had potential effects on bleeding.

**Phase 2**

Thirty subjects participated in phase 2 for whom the demographic characteristics are summarized in Table 1. The mean age was 55 years old with 20% over the age of 65. 100 percent of subjects reported the use of one or more medications with an average of 6.14 medications (prediction mean based on Poisson regression) per patient including prescription and OTC medications. Seventy-seven percent of subjects had one or more discrepancies present in the EMR with a mean of 3.97 discrepancies (SD, 1.99) per patient with a total of 120 discrepancies identified. Of 120 discrepancies, medication not documented (65%) was the most common type of discrepancy, and 44 medications among these undocumented medications had potential to cause negative oral implication on oral health (types of medications described in Table 3). These 44 medications had a total of 77 potential oral health implications with most common being xerostomia.

**Impact of pharmacist-led intervention**

Following the pharmacist-led intervention, a statistically significant difference in the number of medication discrepancies and undocumented medications was observed. The estimated mean number of medication discrepancies decreased by 37.5% from 6.35 to 3.97 between phase 1 and phase 2 (p<0.001). The frequency of undocumented medications was reduced by 41.3% (p<0.001). The mean numbers of undocumented medications were 4.43 and 2.60 at phase 1 and phase 2 respectively. There was no statistically significant reduction observed in the frequency of medications with potential oral health implications among undocumented medications (p=0.2113).

**Discussion**

Medication use is frequent among adults receiving dental care. In this study, a large majority (97.7%) of patients reported taking medications, which is notably greater than the percentage reported by Miller et al (42.3%) or Brindley et al (26%). The average numbers of medications reported to be taken per patient in this study were 7.49 in phase 1 and 6.14 in phase 2, which are also greater than 0.68 drugs per person reported in Miller et al study. These differences may be explained by the growth of medication use in U.S. since 1992 when Miller and colleagues first described the status of medication use among dental patients. Also, the present study included a greater number of subjects over the age of 65 (24.6%) compared to Miller et al (10.2%) and the Brindley et al study (46% compared to 38.7% of the patients aged 60 years or older), and medication use typically increases with age. However, this finding can in
part be explained by the methods used to collect the frequency of medication use, which in the previous studies could have underestimated medication use. The present study utilized a more rigorous and thorough means to obtain the medication lists compared to the previous studies which used chart review or patient reported prescription medications. The large number of discrepancies present in the current study strongly suggests this as a potential confounder in the study conducted by Miller and colleagues. Overall, this study demonstrates dental providers may underestimate and under appreciate the prevalence of medication use in their patients and fail to appropriately assess or document the use of drug therapies.

In this study, undocumented medications were investigated for their potential oral implications because this type of discrepancy presents the greatest risk to the patient when the dental provider is not aware what medications the patient is using. From phase 1, more than half of undocumented medications (64.6%) had potential to cause oral side effects, which is similar to the findings by Miller et al reporting 56.8% of all medications surveyed had the potential to affect dental treatment. Xerostomia was the leading potential oral adverse effect which confirms the findings from the previous research although it was a more common potential problem in the present study. Dental providers should be aware of medications causing dry mouth and should take a proactive approach in identifying patients at risk for this side effect and considering drug therapy as a cause when complaints of dry mouth arise. Other adverse effects related to taste disturbances were common and should also be a high priority for assessment and education.

In addition, numerous medications were identified to affect dental providers’ plan of care by interfering with local anesthetic/vasoconstrictor or effects on bleeding (7.9% and 19.2% respectively). Although the risk is extremely low, it is advised to use caution when vasoconstrictors (epinephrine and levonordefrin) are used in patients taking antidepressants including SSRIs/SNRIs or atypical agents due to a potential increased risk for prolonged QT interval. Furthermore, vasoconstrictors should be administered with caution and vital signs monitored when patients take antidepressants which inhibit the uptake of norepinephrine (e.g., venlafaxine, bupropion) due to a potential elevation in norepinephrine levels. The number of undocumented medications with potential effects on bleeding (19.2%) was higher than reported by Miller and colleagues (11.2%). Many patients taking OTC NSAIDs and low-dose aspirin lacked documentation in the dental record. Because these medications can significantly impact bleeding risk in patients, dental providers should take extra efforts to collect the use of these medications available without prescription. Furthermore, vitamins/supplements were the most commonly undocumented class of medications in this study. Not all vitamins/supplements have clinical implications on oral health. However, vitamin D is reported to potentially cause metallic taste and xerostomia, while fish oil potentially prolongs bleeding time. In order to capture these clinical implications that may be caused by OTC medications and supplements, dental providers must be aware of the use of medications outside of prescription medications in their patients.

Similarly, opioid analgesics, NSAIDs, and antibiotics are commonly prescribed by dental providers. In this study, almost 20% of undocumented medications were represented by one of these three classes. This exposes patients to risk of duplicate therapy and drug interactions when dentists prescribe these medications in addition to the patients’ existing drug therapy. For example, a patient with chronic pain using long- and short-acting opioids and NSAIDs for pain management could easily be prescribed an additional short-acting opioid and NSAID for the treatment of pain related to a dental procedure. The risk of adverse effects from excessive opioid use and additional gastrointestinal risks from this regimen could be costly, if not devastating to a
patient. Given this scenario, the unnecessary prescribing of opioids also presents a public health risk by increasing the amount of unused narcotic analgesics available in the community.

While both Miller et al and Brindley et al conclude that many dental patients take medications with potential oral implications and support the importance of taking a comprehensive medical history at every patient visit, these studies do not assess the accuracy of medication lists collected in their studies. The medication lists collected in the Miller et al study were obtained from the medical history form in the charts, so the accuracy of these medication lists are unknown. Like Miller et al and Brindley et al claim, dental providers should be able to identify oral implications caused by medications. However, collecting an accurate history of patients’ actual medication taking behaviors is the first step for assessing patient use of medications with clinical importance. In the present study, medication discrepancies within the dental record occurred at an alarming rate. The discrepancy rates in this study were similar to or greater than that seen in ambulatory care practice settings without structured or standardized methods for completing medication reconciliation. Much effort has been made in recent years to improve medication list accuracy, and this study suggests similar advances are needed in other outpatient care settings, specifically dental practices.

In this study, a multifaceted pharmacist-led intervention led to a statistically significant reduction in the frequency of medication discrepancies and undocumented medications. A previous study, conducted in an ambulatory care setting, observed a general trend of improved accuracy in medication reconciliation after a pharmacist-led educational intervention. Pharmacist-led education may have a positive impact on accuracy of medication reconciliation processes in a variety of specialist settings. There may be opportunities to impact medication safety in practice settings not typically considered by pharmacists for collaboration.

Limitations

The findings of this study are not without limitations. There are some limits to the ability to generalize the findings to all patients and dental practices due to the setting in which the study was conducted and the population being studied (uninsured, low-income adults). However, the findings related to the clinical implications of medications on oral health and the dental care plan were similar to previous studies. A potential bias could have been introduced through the data collection procedures as there was one pharmacist conducting patient interviews and more than 10 dental providers treating patients during this time. However, this also provided consistency to mitigate variability in patient interviews. During the study period there was a turnover of one dental assistant, which could have affected the consistency of medication histories gathered by the dental assistant. It is unclear what impact this could have on the results, however, the large number of discrepancies existing before and after this change were similar, suggesting that any effect was minimal.

Conclusion and Next Steps

Medication discrepancies are common in dental records and frequently involve medications known to cause oral health problems or potential complications with the dental procedure. This study highlights the importance of improving the accuracy of medication lists available for dental providers. Dental providers should be aware of the importance of collecting accurate medication lists through a proper medication reconciliation process. A pharmacist-led
intervention targeting medication reconciliation processes is an effective strategy for improving the accuracy of medication lists available for dentists. This research demonstrates potential for interprofessional collaboration between dentists and pharmacists in education and medication use processes. Future research could also explore the potential for technology, specifically health information technology, to improve access to complete and accurate information.

Acknowledgements
The authors wish to acknowledge Shannon Sallice, the director of operations at Catholic Charities Free Health Care Center and dental providers and staff for their general support for the study. The authors also wish to acknowledge Dr. Chunhao Tu for his help with statistical data analysis.

References
11. Hersh EV, Moore PA. Three serious drug interactions that every dentist should know about. Compend Contin Educ Dent 2015 36: 408-413.

