

SURVEY OF KANSAS AND MISSOURI GENERAL DENTISTS
IDENTIFYING PERIODONTAL REFERRAL PATTERNS

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Oral and Craniofacial Sciences

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by
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University of Missouri-Kansas City, 2016

ABSTRACT

This investigation surveyed general dentists from Kansas and Missouri to identify factors which may impact how likely they are to refer to periodontists. The web-based survey probed areas of clinician demographics, practice location and characteristics, and periodontal treatment philosophy to see how those domains influenced referrals made to periodontists. Through the Kansas Dental Association (KDA) and the Missouri Dental Association (MDA), 2,819 potential recipients were contacted, yielding 221 responses. Dentists who practiced with at least one other dentist were more likely to refer ($p=0.001$) as were dentists who employed more than one hygienist ($p=0.020$). Offices that frequently provided scaling and root planing were more apt to refer ($p<0.000$). Those who expressed an interest in teledentistry reported referring less ($p=0.032$), indicating that supporting advancement of teledentistry may increase periodontal referrals. Therefore, factors in practice characteristics as well as periodontal treatment philosophy appear to influence periodontal referral patterns.

The faculty listed below, appointed by the Dean of the School of Dentistry have examined a thesis titled “Survey of Kansas and Missouri General Dentists Identifying Periodontal Referral Patterns” presented by Cassandra C. McKenzie, candidate for Master of Science in Oral and Craniofacial Biology, and certify that in their opinion it is worthy of acceptance.

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DEDICATION

It is with the happiest of hearts that I dedicate this thesis to my daughter, Millie. She has brightened my life beyond belief and given my smiles even more spark. Thank you for inspiring me every day.

CHAPTER 1

INTRODUCTION

Periodontal disease causes destructive changes in the oral cavity, leading to deterioration of both hard and soft tissues. Periodontitis can affect the bony support of the teeth significantly. If left untreated, periodontal disease can lead to loss of teeth (Neely et al. 2001; Harris 2003). Additionally, periodontal disease is associated with other chronic inflammatory conditions such as diabetes and hypertension (Klokkevold and Mealey 2012). Clinical manifestations of periodontal disease such as tooth loss have been correlated with multiple systemic conditions (Otomo-Corgel et al. 2012). Ruquet found a strong association between periodontal destruction and coronary heart disease and severe vascular diseases (2014). A systematic review by Manjunath confirmed that “periodontal infections should . . . be considered as a risk factor for various systemic diseases” including cardiovascular diseases, respiratory infections, adverse pregnancy outcomes, rheumatoid arthritis, and diabetes mellitus (2011). Likewise, Ameet’s more recent review emphasized that periodontal infection should be considered a risk factor for atherosclerotic heart disease, stroke, diabetes, and pre-term birth or low birth weight (2013)(Ameet et al. 2013). Therefore, its diagnosis and subsequent treatment are essential for overall patient health.

General dentists have experience, education, and training in treating mild forms of periodontal disease. However, more severe forms are best treated by periodontists (Baker and Needleman 2010). Therefore, proper referrals from general dentists to periodontists are crucial components to comprehensive patient care. As stated above, periodontal disease is often associated with other systemic inflammatory conditions, and diagnosis of

periodontal disease may also indicate the need for other health evaluations (Friedewald et al. 2009). Therefore, diagnosis of periodontal disease and proper referrals are crucial in caring for patients overall, both dentally and systemically. In spite of this, the number of referrals received by periodontists is significantly less than the number of patients with periodontal disease (Oliver and Heuer 1995; Cobb et al. 2003; Dockter et al. 2006). This suggests that periodontal disease is going undertreated. Identifying this lapse in patient care is important for continuity of treatment and overall patient health.

Prevalence of Periodontal Disease

Periodontitis is often seen in adults. The latest prevalence study from 2009-2010 revealed that 47% of the sampled population of 3,742 adults aged 30 years and older had periodontitis, representing 65 million adults in the United States (Eke et al. 2012). Of these, 9% were shown to have mild periodontitis, 30% were shown to have moderate periodontitis, and 9% were shown to have severe periodontitis (Eke et al. 2012). The prevalence of periodontitis appeared to increase with age (Eke et al. 2012). For adults aged 65 years and older, 64% exhibited moderate or severe periodontal disease (Eke et al. 2012). The group of Americans who are 65 years and older is projected to grow by 50% between 2000 and 2020 (Brown et al. 2002). Furthermore, the National Institute on Aging predicts that from 2010 to 2050 the population older than 65 years will increase 188%, likely leading to greater number of patients with periodontal disease (2011).

While periodontal disease is typically considered a disease that affects older adults, children and young adults may also develop periodontal disease. Aggressive periodontitis is more frequently seen in younger populations. Prevalence of aggressive periodontitis varies wildly across geographic areas and appears to be more common in

certain ancestry groups (Susin et al. 2014). People of African ancestry have a 1-5% prevalence of aggressive periodontitis, and Black Americans in North America have a prevalence of 3% (Susin et al. 2014). Because aggressive periodontitis affects people at a younger age, it is crucial for periodontal exams to identify this disease early to prevent major destruction from occurring before detection.

In addition to damaging tooth-supporting structures, periodontal diseases can also affect dental implants. A systematic review and meta-analysis showed that peri-implant mucositis affected 63% of those with implant-supported prostheses and 31% of implants (Atieh et al. 2013). If left untreated, peri-mucositis can progress to peri-implantitis, leading to bone loss and implant failure. The same review found that 19% of those with implants and 10% of implants developed peri-implantitis (Atieh et al. 2013). While peri-implant diseases are not as common as periodontitis, they still remain to be conditions that are treated by periodontists.

Identifying Periodontal Disease

In periodontal disease, the combination of bacterial products and the body's own defense mechanisms lead to destruction of the periodontium (Preshaw and Taylor 2012). If periodontal disease is left untreated, it can progress to loss of teeth (Neely et al. 2001; Harris 2003). Because periodontal disease is typically not painful until the advanced stages, detection by dental health professionals is crucial to limiting periodontal deterioration. Patient reported symptoms which include tooth mobility, root exposure, and food impaction are often indicators of severe disease (Brunsvold et al. 1999). Again, early and moderate stages of periodontal disease do not present with uncomfortable manifestations. Therefore, the clinician must be diligent with disease identification to

reduce periodontal disease progression. Bennett found that general dentists appeared to be relatively standardized with respect to their diagnoses of periodontal disease and disease severity (2010). Dentists reported using similar criteria to evaluate periodontal status and when presented with clinical scenarios, most dentists agree on the diagnoses. Similarly, a study that evaluated the use of the basic periodontal examination found that general dentists use similar, successful strategies to diagnose periodontal disease (Tugnait et al. 2004).

Recognition of periodontal disease and the need to refer have been appreciated by dental schools. The University of Missouri – Kansas City (UMKC) followed dental and dental hygiene students to evaluate their changes in attitudes about periodontal disease management, self-assessment regarding periodontal disease and referral, and knowledge of clinical findings to necessitate referral as well as their applications to clinical situations (Williams et al. 2014). Williams et al found that while 90% of dental and 96% of dental hygiene students reported a willingness to refer patients to periodontists, there was a significant gap between knowledge and applied skills (Williams et al. 2014). The students were comfortable identifying criteria that would necessitate a referral; however, when they were presented with hypothetical situations that warranted referral to a periodontist, the students were inconsistent with their decisions to refer. This discontinuity between academic information and clinical evaluations may be due to students' lack of experience. Therefore, it appears that clinical practice may be an integral component to not only recognizing periodontal disease but making the appropriate referrals.

Consistent with what Williams and colleagues reported about dental and dental hygiene students, a study surveying general dentists found that while general dentists appeared to recognize disease severity in comparable ways, their referral patterns differed significantly. Bennett showed that general dentists reported similar guidelines when determining what disease parameters to consider when referring; however, their actual referral patterns were not coherent with their evaluation of clinical scenarios (2010). While general dentists appear to agree on disease characteristics that necessitate periodontal treatment and referral, the clinical practice of treating and referring patients is not consistent. Thus, recognizing periodontal disease and severity are not the only components to making a referral to a periodontist. There appear to be other factors at play beyond disease recognition and severity appreciation.

Periodontal Treatment Provided by General Dentists

Based on an evaluation of patients newly referred to periodontists, surprisingly, there was no difference in care provided by general dentists in relationship to disease severity (Dockter et al. 2006). Only 27% of those with moderate periodontal disease and 32% of those with severe periodontal disease had “deep cleanings” performed at their general dentists’ office (Dockter et al. 2006). Phase I therapy for patients with periodontal disease includes scaling and root planing or “deep cleaning” as it is used to communicate with patients. According to this study, approximately two-third of referred patients had not received preliminary periodontal therapy. Only 12% of those with moderate periodontitis and 33% of those with severe periodontitis were new patients of the referring dentist, implying that periodontal disease was not being actively treated by

the referring dentist for some time. In addition to the lack of scaling and root planing, referred patients received dental cleanings less than once a year prior to being referred.

Oliver and Heuer (1995) examined dental treatment planned and rendered for patients who had been seeking treatment for 2-3 years at general dentist offices. While 46% of patients had been diagnosed with periodontitis, only around half of those (42%) had scaling and root planing performed. 39% of those with periodontitis were found to have advanced periodontitis; however, only 21% of those with advanced disease were referred to periodontists. Additionally, they found that only 0.05% of patients diagnosed with periodontitis had periodontal surgeries performed by general. This implies those general dentists are not routinely performing periodontal surgical procedures and that those with advanced periodontitis are going undertreated. A previous survey of general dentists in Michigan indicated that while general dentists differ in how many periodontal patients they refer, the amount of periodontal treatment received in the general dentists' offices did not differ significantly (Bennett et al. 2010). General dentists who are not referring are not performing more in-house periodontal treatment. This finding suggests that patients who have periodontal needs and are not referred are not necessarily getting the treatment they require from their general dentists.

The periodontal procedures performed by general dentists only accounts for 5% of all the dental services they provide (Brown et al. 2002). Periodontal procedures have been increasing at 0.5% annually, but this does not match the increase in the population and need of periodontal patients. General dentists tend to provide more restorative services than periodontal services.

A survey of Nova Scotia general dentists noted that most general dentists reported performing non-surgical periodontal treatment, such as scaling and root planing, periodontal maintenance, and bruxism therapy (Ghiabi and Matthews 2012). However, this information was self-reported and did not include information on how many patients received these services. Therefore, the general dentists in this survey offer non-surgical periodontal treatment, but it is unknown how many patients are treated for periodontal disease. As for surgical periodontal therapy, the survey demonstrated that 29% general dentists performed frenectomies, 29% performed gingivectomies, and 17% performed crown lengthening procedures (Ghiabi and Matthews 2012). For more advanced periodontal needs such as osseous surgery or gingival grafting, general dentists reported to refer patients to periodontists (Ghiabi and Matthews 2012).

Periodontal Referrals by General Dentists

According to Baker and Needleman, one of the fastest growing areas of litigation in dentistry is related to periodontal care (2010). Currently, 5-12% of all dental malpractice claims are for inadequate or lack of periodontal treatment, while 3-15% of claims are due to other situations such as implant failures and failure to refer (Seidberg 2007). More claims are being filed for failure to adequately diagnose or treat periodontal disease. Often times, patients are not made aware of their disease or are referred after irreversible damage has been caused by periodontal disease (Baker and Needleman 2010). As society becomes more litigious, it is important for clinicians and patients to appreciate the significance of not treating or referring patients with periodontal disease appropriately.

Periodontal disease is typically not overtly symptomatic until advanced stages of the disease (Preshaw and Taylor 2012). The symptom patients self-report commonly is mobility. After a periodontally-affected tooth becomes mobile, there is usually a significant lack of attachment, and treatment options may be limited. For periodontal disease to be best treated, clinicians must first recognize the disease and then refer in a timely manner. The destructive signs that may be unknown to patients should be obvious to a general dentist or other dental professional when performing a periodontal exam (Brunsvold et al. 1999). Without professional periodontal care, patients with untreated periodontal disease are at significant risk for losing teeth (Neely et al. 2001; Harris 2003). When patients are referred to periodontists with mild or moderate periodontal disease, more teeth can be saved than when they are referred at the severe disease stage (Cobb et al. 2003). Therefore, appreciation of periodontal disease and referral by general dentists are essential for thorough patient care.

Periodontal Referral Factors and Statistics

A study that compared new periodontal referrals from 1980 to 2000 unearthed some surprising findings for periodontal practices in Kansas City, MO, Tucson, AZ, and St. Augustine, FL (Cobb et al. 2003). In that 20-year span, it was found that there was an increase in the average age of patients being referred. There was also a trend observed in decreased tobacco use in referred patients. Additionally, patients being referred had more missing teeth and were treatment planned for more extractions. These findings suggest that the severity of disease at referral is more advanced, and this appears to be consistent for a variety of locations.

When reviewing records for patients who had been seen at private general dental practices for two to three years, Oliver and Heuer found that 5% of patients were referred to periodontists, even though 46% of patients had been diagnosed with periodontitis. Of those with advanced periodontitis, only 21% were referred to a periodontist (Oliver and Heuer 1995). However, merely 346 out of the 600 patients surveyed had partial or complete periodontal charting and could lead to a periodontal diagnosis, meaning that 43% of patients could not be diagnosed with either healthy or diseased periodontium (Oliver and Heuer 1995). Complete charting was found for just 29% of patients (Oliver and Heuer 1995), indicating a lack of thorough periodontal documentation.

Manski and Moeller (2002) found that only 3% of all dental visits in 1996 were for endodontists or periodontists. They also showed that 2% of patients had visits to a periodontist or endodontist, indicating that patients often required additional appointments. Their analysis of dental visits through the 1996 Medical Expenditure Panel Survey suggest that periodontal needs are not being addressed if such a small percentage of patient care is devoted to periodontal health.

When referred to a periodontist, Dockter found that most patients typically made their evaluation appointments within one year (2006). This finding indicates that most patients, when referred to a periodontist, will be seen for a consultation. This finding suggests that the burden of disease recognition and appropriate referral falls on the general dentist.

Relationship between General Dentists and Periodontists

A previous survey study found that the most common reason that general dentists choose to refer is their own inadequate training or experience, as this was cited by 79% of

those surveyed (Ghiabi and Matthews 2012). While the reasons to refer seem objective, the reasons general dentists select a particular periodontist seems to be based on more subjective criteria. With respect to choosing an individual periodontist, the most universal criteria claimed include previous patient satisfaction (75%), personality of the periodontist (71%), and previous success with the periodontist (70%) (Ghiabi and Matthews 2012). Therefore, the interpersonal interactions between both the periodontist and general dentist as well as between the periodontist and the general dentist's patients may be important factors in the general dentist's decision to refer.

When surveying general dentists and periodontists in Kentucky, it was reported that while general dentists ranked clinical skill as the most important when selecting a periodontist, other criteria other than clinician competence were ranked within the top five factors (Park et al. 2011). General dentists rate the following factors as being important when choosing to refer to a periodontist: previous positive experience with the specialist, specialist's skill of communication, likelihood of good patient and specialist rapport, and similar practice philosophies with the specialist (Park et al. 2011). This is in contrast to what periodontists thought were important. Surveyed periodontists ranked clinical skill as seventh on a list of sixteen factors compared with how general dentists ranked this quality as first (Park et al. 2011). Periodontist ranked the specialist's reputation in the community higher than general dentists did when considering referral (Park et al. 2011). While both general dentists and periodontists appear to value the professional relationship, general dentists report to appreciate clinical skill more so than the periodontists in terms of factors important for referral.

Geographic Trends in Periodontal Referrals

A sample of 100 newly referred patients to greater Kansas City periodontal practices showed that 74% were diagnosed with severe periodontitis (Dockter et al. 2006). Of those referred, 29.8% were treatment planned by the periodontist for two or more extractions, demonstrative of the extent of their disease (Dockter et al. 2006). A chart audit evaluating referral changes over 20 years at one Kansas City periodontal practice showed a trend of increased initial diagnosis of severe periodontitis, suggesting that general dentists are referring more severe cases (Cobb et al. 2003). Therefore, it appears that general dentists refer patients with severe periodontal disease to periodontists in the greater Kansas City area. While this appears to be beneficial for patients who have severe periodontal disease, early referrals when the disease is mild or moderate lead to more successful treatment and more long term options.

When reviewing private practice records from Minnesota and Arizona, in both rural and metropolitan locations, Oliver and Heuer (1995) noted that just over half of the patients with indicators of periodontal disease, such as substantial gingival inflammation, deep periodontal pockets, or excessive calculus, received scaling and root planing or were referred to a periodontist. This suggests almost one out of every two patients with periodontal disease was untreated. This pattern was similar for both rural and urban locations in Minnesota and Arizona (Oliver and Heuer 1995).

Clinician Factors in Periodontal Referrals

Gender may have an effect on periodontal referrals. Women are more than two and a half times as likely as their male counterparts to refer patients to periodontists (Zemanovich et al. 2006). Another study confirmed these findings, showing that women

were more likely to refer complex procedures while men were more likely to perform those procedures themselves (Zitzmann et al. 2011). While the reasons for this trend are unknown, it presents an interesting development for the future. From 2001 to 2012, the number of active, licensed, female dentists rose 44%, from 26,870 to 47,814 (Fox 2012). Therefore, the sheer number of women dentists may cause an increase in periodontal referrals as more female clinicians emerge.

A survey of general dentists in Nova Scotia found that general dentists were more likely to perform surgical periodontal procedures if they had some or all of the following characteristics: felt well prepared by their periodontal education while in dental school, had increased interest in periodontics following graduation from dental school, did not intend on taking continuing education courses in nonsurgical periodontics in the next two years, and planned on taking continuing education courses in implant placement within the next two years (Ghiabi and Matthews 2012). Additionally, Ghiabi and Matthews highlighted that there was a positive correlation between general dentists performing surgical periodontal procedures and hours of continuing education courses in periodontics as well as number of years in private practice (2012). Therefore, general dentists with the above qualities are more likely to treat their patients' periodontal needs in-house and are less likely to refer to periodontists.

A survey of general dentists in Michigan also revealed clinician qualities which seem to influence periodontal referral patterns. Lee found that the more positively general dentists evaluated their dental school experience in periodontics, the less likely they were to refer to periodontists (2009). Clinicians, who felt that their education better prepared them for periodontics, tended to treat patients' periodontal needs themselves.

Those who felt well prepared by their periodontal training in dental school also were more conservative when considering what percentage of bone loss indicates a referral, more frequently prescribed systemic antibiotics when treating periodontitis, and considered whether their patients would return following periodontal treatment as a concern when deciding to refer (Lee et al. 2009). Therefore, dental school perceptions may influence how a general dentist chooses to refer.

Practice Factors in Periodontal Referrals

The number of dentists in a practice can affect periodontal referrals. Zemanovich found that dentists who practice with one other dentist are twice as likely to refer more patients to periodontists than are dentists who practice solo or in a group practice with three or more dentists (2006). In larger practices, there may be a general dentist who has greater periodontal interests. Therefore, rather than referring to an outside periodontists, dentists in a large practice may simply have that dentist perform the necessary procedures. On a similar note, in a two-doctor practice, the dentists may share similar practice and treatment philosophies. Thus, those practices may have a greater appreciation for periodontal disease and refer accordingly.

Dental insurance may play a role in periodontal treatment. Oliver and Heuer found that while overall periodontal treatment services were not different for those with dental insurance, the only three patients who had periodontal surgery in their study had dental insurance (1995). They also noticed that oral hygiene instructions were reported more for patients who were insured (Oliver and Heuer 1995). It should be noted that oral hygiene reinforcement may be occurring for non-insured patients and simply not recorded. Another study showed that general dentists who make the least periodontal

referrals also have the highest number of uninsured patients (Bennett et al. 2010).

Similarly, Lee found that general dentists who refer more periodontal patients have more patients with private dental insurance (2009). It does appear that those with dental insurance are more likely to be referred and to have periodontal treatment.

The patient's ability to afford periodontal treatment or the referring dentist's opinion on if the patient can afford treatment may be an influencing factor. Bennett found that dentists who reported referring the least amount of patients had the highest percentage of patients with low socioeconomic status as well as the lowest number of patients with high socioeconomic status (2010). Likewise, Lee found that general dentists who refer more frequently have fewer patients from low socioeconomic backgrounds (Lee et al. 2009). Manski and Moeller found that poorer patients reported fewer visits to a periodontist than more affluent patients (2002). This discovery may indicate that the patients of low socioeconomic backgrounds are being referred less frequently, or it may be that those patients are choosing not to pursue periodontal treatment. Manski also reported that patients with less education had less periodontal visits (2002). Together, these findings suggest that socioeconomic status plays a role in periodontal referral patterns.

Proximity to a periodontist may influence referral patterns and periodontal treatment. Access to general dentists is limited in so-called dental deserts where patients are separated from the nearest general dentist by more than 30 minutes of travel time (Kimminau and Wellever 2011). In Kansas, there are four large dental deserts and 15 counties without a single general dentist (Kimminau and Wellever 2011). Therefore, it is logical to assume that specialists such as periodontists are even less geographically

diverse as general dentists, limiting their proximity to patients. Oliver and Heuer found that patients from rural areas had scaling and root planing completed by general dentists more often than those from metropolitan areas, indicating that geographic location may play a factor in periodontal treatment (1995). Likewise, a study from the United Kingdom found that the only factor significantly influencing the number of referrals by general dentists was the distance to the periodontist, with the greatest distance being associated with less referrals (Linden et al. 1999). In Nova Scotia, 65 % of general dentists surveyed reported that availability in the community was critical for choosing to refer to a periodontist (Ghiabi and Matthews 2012). In contrast to these findings, Zemanovich found that general dentists in Virginia who were over five miles away from their closest periodontist referred more than those dentists who were closer than five miles to a periodontist (2006). Therefore, extremes in proximity such as being too close or too far away may influence how a general dentist refers to a periodontist.

Hygienists appear to play a role in periodontal referral patterns. Dentists who employ two or more full-time hygienists are more than twice as likely to refer more patients to periodontists than are dentists who have one or no hygienists (Zemanovich et al. 2006). The education and training that hygienists receive focus on periodontal needs and disease detection. Hygienists have the opportunity to detect indications for periodontal treatment that may be missed in a busy dental practice. Hygienists can function as a “second set of eyes” for dentists (Zemanovich et al. 2006). Therefore, periodontal disease may be more readily diagnosed in practices with more hygienists, leading to more periodontal referrals.

Previous Data Collection

Acquisition of data regarding periodontal referral patterns has been primarily accomplished through surveying. Surveys of clinicians have been used to gather periodontal practice philosophies as well as demographic and clinic information (Zemanovich et al. 2006; Lee et al. 2009; Bennett et al. 2010; Chang et al. 2014). Other strategies used to collect information regarding referrals include chart reviews, analysis of the National Health and Nutrition Examination Surveys (NHANES), and insurance records (Brown et al. 2002; Cobb et al. 2003; Dockter et al. 2006). While other methods of eliciting information have their benefits, surveys have the advantage of collecting the exact information desired as well as subjective data. That is, one can ask for the precise values such as number of patients referred to a periodontist for week as well as gain information about the clinician's practice philosophies that contribute to his or her referrals.

Current survey strategies include using traditional "paper-and-pen" as well as electronic versions. Web-based surveys tend to collect more thorough data (Kongsved et al. 2007). The main challenge with surveys as a data collection instrument is eliciting responses. Therefore, greater care must be taken to maximize return potential. While they can gather more complete data, the response rate for electronic questionnaires can be lower than for traditional mailed back surveys (Kongsved et al. 2007). However, more recent comparisons of traditional versus web-based show that response rates for electronic surveys are improving and can be comparable to "paper-and-pen" surveys (Hohwu et al. 2013). Differences among response rates are likely due to generational preferences.

Response rate has been shown to increase with pre-notification (Edwards et al. 2009). Therefore, preliminary contact should be established prior to administration of the survey. Additionally, follow-up contact is also crucial to ensuring survey completion (Edwards et al. 2009). Thus, participants should be contacted after surveys have been dispersed to remind them to respond. Monetary incentives have been shown to double response rate (Edwards et al. 2009). Similarly, personalizing the e-mail with a picture tripled the response rate (Edwards et al. 2009). Therefore, it is crucial to maximize the return rate by implementing known strategies to encourage respondents.

Problem Statement

While periodontal disease is common, referrals to periodontists continue to be inconsistent among general dentists. Results from multiple surveys have shown the disproportionate nature of periodontal referrals compared to those who are afflicted by periodontal disease. When patients are referred to periodontists, their periodontal disease tends to be of greater severity, leaving the patient and the periodontist with less treatment options than if a referral was made when the disease was mild or moderate. By identifying factors that impact general dentists' decisions to refer to periodontists, those aspects can be used to facilitate positive referring relationships, leading to more timely and appropriate referrals to periodontists. This study aims to identify patterns in periodontal referrals in Kansas and Missouri by surveying general dentists.

Hypotheses

1. General dentist demographics, such as gender, student debt, periodontal continuing education, and year of dental school graduation, influence referrals to periodontists.
2. Practice location and characteristics, such as number of clinicians and in-house specialists, percentage of patients who are insured, and number of hygienists, affect periodontal referral patterns.
3. Periodontal treatment philosophies guide periodontal referral patterns.

CHAPTER 2

MATERIALS AND METHODS

Survey Methodology

An electronic survey instrument to be distributed to general dentists was developed. The survey and the associated protocol were approved by the UMKC Institutional Review Board (15-094-Appendix A).

Survey Design

The design of the survey instrument was based on previous surveys of general dentists regarding periodontal practice philosophies as well as demographic and clinic information. The survey questions focused specifically on three main domains: (1) clinician demographics (2) practice location and characteristics, and (3) periodontal treatment philosophy. Clinician demographics requested included gender, year of dental school graduation, hours worked per week, advanced training, continuing education, study club activity, and study debt load. Practice location and characteristics requested included location, population in which the practice was located, distance to nearest periodontist, state in which practice is located (Kansas or Missouri), number of patients seen per week as well as number of patients referred to a periodontist per week, number of hygienists and other dental professionals in practice, and insurance acceptance. Periodontal treatment philosophy included when clinicians choose to refer to treat periodontal disease, periodontal services provided, considerations when making a periodontal referral, and other reflections regarding periodontal treatment.

Prior to finalizing the survey, a focus group of general dentists from the UMKC School of Dentistry faculty was asked to review the survey. The focus group provided

feedback on survey format, content, and phrasing. Their input helped to enhance understandability, comprehensiveness, and neutrality of the questions. Based on their recommendations, the survey was updated accordingly. See Appendix B for survey.

Data Collection

Survey data was collected and processed through REDCap (Research Electronic Data Capture), a secure, web-based application. REDCap is hosted at the Center for Health Insights of the University of Missouri-Kansas City and allows for an interface for data entry and protected storage of information.

A convenience sample of active members in the Kansas Dental Association (KDA) and Missouri Dental Association (MDA) was targeted for this study. Due to differences in their organizations' communication with their members, varying strategies were used to reach members. While the KDA opted to communicate on a more personalized level with their members regarding the survey, the MDA wished to limit the amount of times their members are contacted. The different approaches to distribute surveys are outlined below:

With respect to the KDA, electronic surveys were e-mailed to active members via their organization's list-serv by their membership manager. The following strategies were employed to maximize responses from KDA members:

1. Response rate has been shown to increase with pre-notification. Therefore, preliminary emails were sent to active members of the KDA to describe the project and alert members that a survey will be sent in the near future.

2. After one week, another email was sent with the survey link and additional information about the survey. The email requested that respondents complete the survey within 10 days.
3. Follow-up contact is also crucial to ensuring survey completion. Thus, a third email was sent to members of the KDA, reminding them to complete the survey two weeks after the last email was sent.
4. A second reminder email was sent.

To reach the active members of the MDA, a brief description of the project along with the survey link was included in the MDA’s monthly e-mail newsletter for two consecutive months. Additionally, the survey link and a concise explanation of project was posted on the MDA’s Facebook® page.

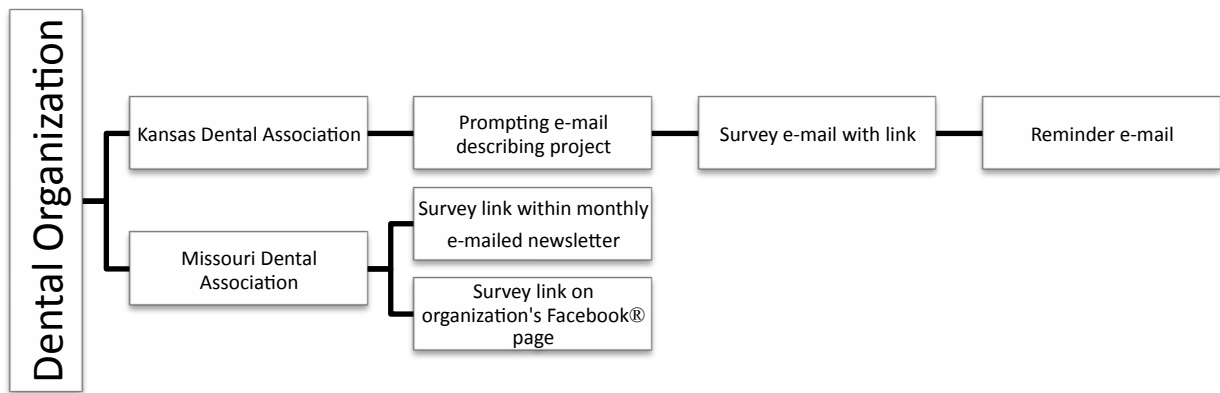


Figure 1. Survey distribution for KDA and MDA

Visits were made to local KDA and MDA meetings to encourage respondents. These served to further educate dentists about the potential merits of the project as well as to encourage participation in the surveys. See appendices C and D for correspondence among members of the KDA and MDA.

To increase responses, monetary incentives were used. At the completion of the survey, participants were prompted to enter an email address to be used to randomly select a participant for receipt of a \$50 giftcard to Amazon.com. To ensure anonymity, the contact information conferred was kept separately from the survey information to be analyzed.

Sample Size and Experimental Design

Surveys were distributed to a convenience sample of active members (n=2819) in the Kansas Dental Association (KDA) (n=936) and Missouri Dental Association (MDA) (n=1,883). This study utilized a three-factor, non-experimental design. The dependent variable assessed was number of referrals to a periodontal office in a month. The three types of independent variables were (1) general dentist demographics, (2) practice location and characteristics, and (3) periodontal treatment philosophies. Among these three, global, independent variables were more specific features that may be associated with periodontal referral patterns. Table 1 outlines the experimental design dependent and independent variable specifics.

TABLE 1
EXPERIMENTAL DESIGN: DEPENDENT AND INDEPENDENT VARIABLE
SPECIFICS

Dependent variable	Independent variables	Specific details
Number of periodontal referrals per month	General dentist - clinician demographics	Gender
		Year of dental school graduation
		State of practice (KS vs. MO)
		Hours worked in average week
		Advanced training
	Practice location and characteristics	Hours of continuing education
		Study club participation
		Dental school student debt
		Number of dentists in practice
		Number of hygienists in practice
Periodontal treatment philosophy	Number of dental specialists in practice	
	Practice location	
	Patients seen per week	
	Nearest periodontist	
	Insurance plans accepted	
		Periodontal services provided
		Personal preference in referring
		Periodontal services provided
		Strategies on when to refer and/or treat
		Interest in teledentistry

Data Analysis

The collected survey data was evaluated using a software analysis program¹. Responses were removed from the data set if the responder practiced as a dental specialist; therefore, the only responses evaluated were those of general dentists'. Additionally, responses were removed if more than half of the survey questions were unanswered. Descriptive statistics was used to characterize the respondents' demographics, clinic characteristics, and periodontal treatment philosophy. Chi-square tests were performed for two level variables such as gender and state of practice.

¹ SPSS Statistics, Version 22, IBM, Armonk, NY 10504-1722

To examine the underlying factor structure of items assessing the domains of practice demographics, clinician characteristics, and periodontal treatment philosophy, effect testing was completed using either Kruskal-Wallis or Chi-square analysis.

Statistical Analysis

Descriptive statistics (means, standard deviations, medians, interquartile ranges, counts, and percentages) were calculated for variables of interest. Associations between periodontal referrals and factors of interest were tested using Chi-square tests and Fisher's Exact tests. P values ≤ 0.05 were considered statistically significant.

CHAPTER 3

RESULTS

Of the potential 2819 recipients of the surveys, 221 responded. Of the 221 survey responses, the following exclusion criteria were applied: responses were removed if the responder was practicing as a specialist and if the responder left more than 50% of the questions unanswered. See below for a schematic illustrating the flow of respondent data.

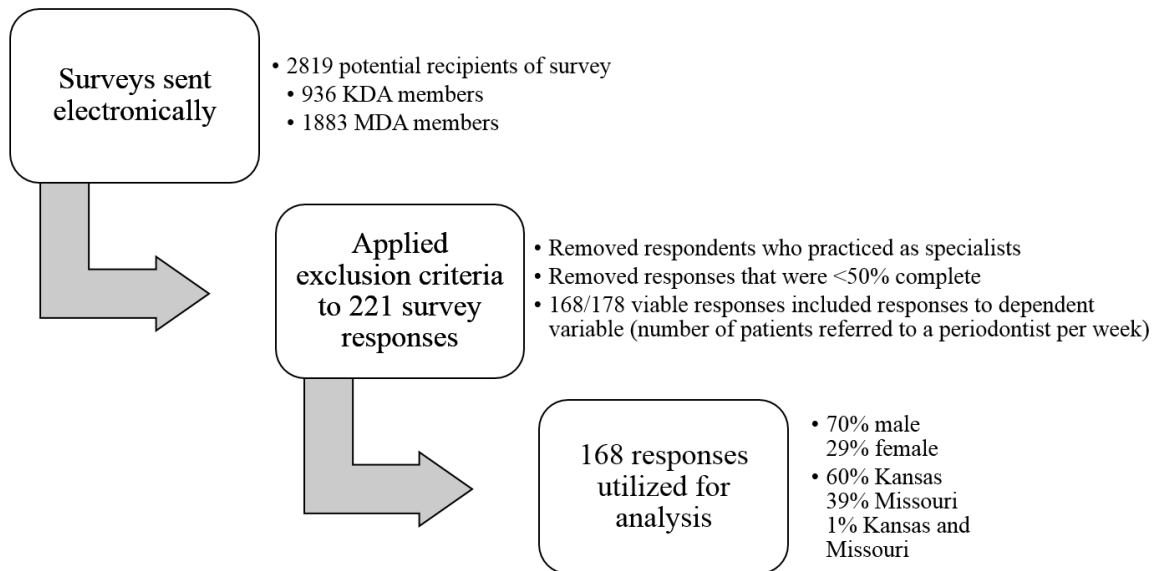


Figure 2. Data Set Compilation

While there were a total of 178 viable survey responses, 168 (94%) of those had a response to the question about the number of patients per week that they refer to a periodontist. The number of patients referred per week represents the dependent variable in this study, and one will see that dependent variable in the tables below. Table 2

presents responses to the first category evaluated, clinician demographics by number of patients referred to a periodontist in one week.

TABLE 2

CLINICIAN DEMOGRAPHICS AND NUMBER OF PERIODONTAL REFERRALS

		Number of patients per week referred to a periodontist				
		N = 168	0-3 N = 126	4-10 N = 38	>10 N = 4	p-value*
		N (%)	N (%)	N (%)	N (%)	
<i>Demographic Characteristics</i>						
Gender						0.868
	Male	118 (70.2%)	90 (76.3%)	25 (21.2%)	3 (2.5%)	
	Female	49 (29.2%)	36 (73.5%)	12 (24.5%)	1 (2.0%)	
	Unanswered	1 (0.6%)				
Years Since Graduated Dental School						0.116
	< 10 years	40 (23.8%)	29 (72.5%)	10 (25.0%)	1 (2.5%)	
	11 – 20 years	16 (9.5%)	8 (50.0%)	8 (50.0%)	0 (0.0%)	
	21 – 30 years	41 (24.4%)	33 (80.5%)	6 (14.6%)	2 (4.9%)	
	> 30 years	69 (41.1%)	54 (78.3%)	14 (20.3%)	1 (1.4%)	
	Unanswered	2 (1.2%)				
Current Debt from Dental School						0.313
	< \$10,000	113 (67.3%)	88 (77.9%)	23 (20.4%)	2 (1.8%)	
	\$10,000 – \$100,000	19 (11.3%)	14 (73.7%)	5 (26.3%)	0 (0.0%)	
	\$100,001 - \$250,000	19 (11.3%)	13 (68.4%)	6 (31.6%)	0 (0.0%)	
	> \$250,000	5 (3.0%)	3 (60.0%)	1 (20.0%)	1 (20.0%)	
	Unanswered	12				

(7.1%)

Table 2 Continued

		Number of patients per week referred to a periodontist				
		N = 168	0-3 N = 126	4-10 N = 38	>10 N = 4	p-value*
		N (%)	N (%)	N (%)	N (%)	
State Practices In						
					0.158	
	Missouri	65 (38.7%)	50 (76.9%)	13 (20.0%)	2 (3.1%)	
	Kansas	100 (59.4%)	75 (75.0%)	23 (23.0%)	2 (2.0%)	
	Both Missouri and Kansas	2 (1.2%)	0 (0.0%)	2 (100.0%)	0 (0.0%)	
	Unanswered	1 (0.6%)				
Hours Worked in an Average Week						
					0.454	
	< 25 hours	14 (8.3%)	10 (71.4%)	4 (28.6%)	0 (0.0%)	
	25 – 32 hours	40 (23.8%)	29 (72.5%)	10 (25.0%)	1 (2.5%)	
	33 – 40 hours	97 (57.7%)	77 (79.4%)	18 (18.6%)	2 (2.1%)	
	> 40 hours	17 (10.1%)	10 (58.8%)	6 (35.3%)	1 (5.9%)	
	Unanswered	0 (0%)				
Current Education Characteristics						
Continuing Education						
					0.915	
	Obtained Minimum Required	9 (5.4%)	7 (77.8%)	2 (22.2%)	0 (0.0%)	
	Obtained ≤ 10 CE above Minimum	73 (43.4%)	56 (76.7%)	16 (21.9%)	1 (1.4%)	
	Obtained ≥ 10 CE Above Minimum	85 (50.6%)	62 (72.9%)	20 (23.5%)	3 (3.5%)	
	Unanswered	1 (0.6%)				
Active in Study Club						
					0.576	
	Yes	87 (51.8%)	68 (78.2%)	17 (19.5%)	2 (2.3%)	
	No	80 (47.6%)	57 (71.3%)	21 (26.3%)	2 (2.5%)	

Unanswered 1
 (0.6%)

*Calculated using Fisher's Exact test

The majority of the respondents reported to be male. Most of the respondents (41%) reported that they graduated from dental school more than 30 years ago. The next largest category (24%) consisted of those who had graduated 21-30 years ago. Missouri dentists only accounted for 39% of respondents while Kansas dentists were 59% of responders. Most responders reported practicing 33-40 hours a week (58%). Almost 95% of responders stated that they obtain more than the minimum required amount of continuing education, and over half of responders reported being active in a study club.

None of the clinician demographic variables were significantly associated with the number of patients referred to a periodontist per week. (Table 2)

Dentists who practice with more than one other dentist are more likely to refer to periodontists ($p=0.001$, Table 4) as are dentists who have more than one hygienist ($p=0.020$, Table 4). Therefore, Table 3 shows how clinician demographics are related to number of hygienists or other dentists in practice.

TABLE 3
 CLINICIAN DEMOGRAPHICS AND NUMBER OF DENTISTS AND
 HYGIENISTS IN PRACTICE

State	Gender	Years since graduation	Practice with at least one other dentist	More than one hygienist
Kansas	Male	<10	5 (16%)	10 (15%)
		11-20	3 (10%)	5 (8%)
		21-30	4 (13%)	14 (21%)
		>30	19 (61%)	37 (56%)
	Female	<10	10 (63%)	13 (52%)
		11-20	1 (6%)	4 (16%)
		21-30	2 (13%)	6 (24%)
		>30	3 (19%)	2 (8%)
Missouri	Male	<10	2 (13%)	4 (13%)
		11-20	3 (23%)	4 (13%)
		21-30	2 (13%)	7 (22%)
		>30	9 (56%)	17 (53%)
	Female	<10	11 (58%)	11 (50%)
		11-20	2 (11%)	4 (19%)
		21-30	4 (21%)	5 (23%)
		>30	2 (11%)	2 (9%)

As male dentists practice longer, they are more likely to practice with at least one other dentist. In direct contrast, female dentists appear to be more likely to practice with at least one other dentist earlier in their careers. A similar pattern was seen for hygienists. Again, male dentists are more likely to employ more hygienists as they gain clinical experience while female dentists are more likely work with more than one hygienist when they have been practicing for less than ten years. These trends appear consistent for both Kansas and Missouri. (Table 3)

Table 4 presents responses to the second domain evaluated, practice locations and characteristics by number of patients referred to a periodontist in one week.

TABLE 4
PRACTICE LOCATION AND CHARACTERISTICS AND NUMBER OF PERIODONTAL REFERRALS

	N = 168 N (%)	Number of patients per week referred to a periodontist			p-value*
		0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
<i>Practice characteristics</i>					
Number of dentists, including specialists, in responder's practice					0.001
1 dentist	90 (53.6%)	78 (86.7%)	12 (13.3%)	0 (0.0%)	
2 dentists	38 (22.6%)	23 (60.5%)	13 (34.2%)	2 (5.3%)	
3+ dentists	40 (23.8%)	25 (62.5%)	13 (32.5%)	2 (5.0%)	
Unanswered	0 (0%)				
Specialists in practice					
Endodontist	5 (3.0%)	2 (40.0%)	2 (40.0%)	1 (20.0%)	0.039
Pathologist	1 (0.6%)	0 (0.0%)	1 (100%)	0 (0.0%)	0.250
Radiologist	1 (0.6%)	1 (100%)	0 (0.0%)	0 (0.0%)	>0.999
Oral surgeon	10 (6.0%)	9 (90.0%)	0 (0.0%)	1 (10.0%)	0.051
Orthodontist	11 (6.5%)	11 (100%)	0 (0.0%)	0 (0.0%)	0.127
Pediatric dentist	3 (1.8%)	3 (100%)	0 (0.0%)	0 (0.0%)	>0.999
Periodontist	4 (2.4%)	3 (75.0%)	0 (0.0%)	1 (25.0%)	0.128
Prosthodontist	2 (1.2%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	0.047

Table 4 Continued

	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
Hygienists in practice					0.020
0 hygienists	26 (15.5%)	24 (92.3%)	2 (7.7%)	0 (0.0%)	
1 hygienist	42 (25.0%)	36 (85.7%)	6 (14.3%)	0 (0.0%)	
2+ hygienists	100 (59.5%)	66 (66.0%)	30 (30.0%)	4 (4.0%)	
Patients seen per week					0.178
<40 patients	21 (12.5%)	19 (90.5%)	2 (9.5%)	0 (0.0%)	
41-60 patients	35 (20.8%)	28 (80.0%)	7 (20.0%)	0 (0.0%)	
61-80 patients	32 (19.0%)	27 (84.4%)	5 (15.6%)	0 (0.0%)	
>80 patients	79 (47.0%)	52 (65.8%)	24 (30.4%)	3 (3.8%)	
Unanswered	1 (0.6%)				
Practice location					0.275
Rural (<2,500 residents)	16 (9.5%)	15 (93.8%)	1 (6.3%)	0 (0.0%)	
Urbanized cluster (2,500-50,000 residents)	64 (38.1%)	46 (71.9%)	15 (23.4%)	3 (4.7%)	
Urbanized area (>50,000)	85 (50.6%)	62 (72.9%)	22 (25.9%)	1 (1.2%)	
Unanswered	3 (1.8%)				
Nearest periodontist					0.075
<10 miles	103 (61.3%)	72 (69.9%)	27 (26.2%)	4 (3.9%)	
10-30 miles	28	20	8	0	

>30 miles	(16.7%) 36	(71.4%) 33	(28.6%) 3	(0.0%) 0
Unanswered	(21.4%) 1	(91.7%) 1	(8.3%) 0	(0.0%) 0
	(0.6%)			

Table 4 Continued

	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
<i>Fee for service/insurance participation</i>					
Fee for service	40 (23.8%)	30 (75.0%)	10 (25.0%)	0 (0.0%)	0.628
Participate in insurance	127 (75.6%)	96 (75.6%)	27 (21.3%)	4 (4.5%)	
Direct reimbursement	66 (39.3%)	49 (74.2%)	14 (21.2%)	3 (1.8%)	0.409
Indemnity plan	94 (56.0%)	75 (79.8%)	18 (19.1%)	1 (1.1%)	0.180
Preferred provider organization (PPO)	94 (56.0%)	72 (76.6%)	20 (21.3%)	2 (2.1%)	0.893
Dental health maintenance organization (DHMO)	16 (9.5%)	11 (68.8%)	4 (25.0%)	1 (6.3%)	0.400
Medicaid/Medicare	30 (17.9%)	25 (83.3%)	4 (13.3%)	1 (3.3%)	0.344

*Calculated using Fisher's Exact test

About half of the responders practiced by themselves, 23% practiced with another dentist, and 24% practiced with two or more dentists. Dentists in solo practices were less likely to refer than those who were in practices with two or more other dentists (p=0.001).

Very few offices have other specialists in house, with the most saying they had an orthodontist in the same practice (7%). Those with endodontists or prosthodontists in the

same practice are more likely to refer to periodontists ($p=0.047$ and $p=0.039$, respectively).

Greater than half the dentists surveyed have two or more hygienists (60%), while 16% of offices had no hygienists. Number of hygienists in the practice is positively correlated with periodontal referrals made ($p=0.020$).

Most dentists (47%) see more than 80 patients a week. However, seeing more patients a week does not correlate with referring more patients to a periodontist. Only 10% of responding dentists practice in rural areas of less than 2,500 residents while 51% practice in areas of more than 50,000 residents. The population density within which a dentist practices does not appear to influence how many periodontal referrals a dentist makes. Most responding dentists reported that the nearest periodontist was located less than ten miles away while 21% stated that they were located more than 30 miles away. However, location of nearest periodontist was not associated with number of periodontal referrals. Most offices (76%) participate with insurance plans. Nonetheless, neither participation with insurance plans nor type of insurance plans accepted correlated with periodontal referrals made. (Table 4)

Questions representing the responding dentists' clinical judgment stratified by number of patients referred to periodontist per week is reported in Table 5.

TABLE 5

PROBING DEPTH AT WHICH RESPONDER WOULD RECOMMEND
PERIODONTAL INTERVENTION AND NUMBER OF
PERIODONTAL REFERRALS

	N = 168 N (%)	Number of patients per week referred to a periodontist			p-value*
		0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
When responder recommends periodontal surgery					0.680
3 mm	3 (1.8%)	2 (66.7%)	1 33.3%	0 (0.0%)	
4-5 mm	16 (9.5%)	13 (81.3%)	3 (18.8%)	0 (0.0%)	
6-7 mm	85 (50.6%)	66 (77.6%)	18 (21.2%)	1 (1.2%)	
8-9 mm	55 (32.7%)	39 (70.9%)	13 (23.6%)	3 (5.5%)	
Unanswered	9 (5.4%)				
When responder refers patient to a periodontist					0.356
3 mm	4 (2.4%)	4 (100%)	0 (0.0%)	0 (0.0%)	
4-5 mm	17 (10.1%)	14 (82.4%)	3 (17.6%)	0 (0.0%)	
6-7 mm	111 (66.1%)	77 (69.4%)	31 (27.9%)	3 (2.7%)	
8-9 mm	35 (20.8%)	30 (85.7%)	4 (11.4%)	1 (2.9%)	
Unanswered	1 (0.6%)				

*Calculated using Fisher's Exact test

The majority of responders (51%) state that they would recommend periodontal surgery when a patient has probing depths of 6-7 mm whereas 66% of responders would refer a patient to a periodontist when probing depths are 6-7 mm. (Table 5)

Table 6 highlights responders' in-house periodontal treatment stratified by the number of patients per week that they refer to a periodontist.

TABLE 6
PERIODONTAL TREATMENT OFFERED BY RESPONDER AND FREQUENCY OF TREATMENT WITH NUMBER OF PERIODONTAL REFERRALS

<i>Periodontal services offered</i>	N = 168 N (%)	Number of patients per week referred to a periodontist			p-value*
		0-3 N (%)	4-10 N (%)	>10 N (%)	
Scaling and root planing					<0.001
Never	8 (4.8%)	8 (100%)	0 (0.0%)	0 (0.0%)	
Sometimes	118 (70.2%)	97 (82.2%)	20 (16.9%)	1 (0.8%)	
Often	41 (24.4%)	21 (51.2%)	17 (41.5%)	3 (2.4%)	
Unanswered	1 (0.6%)				
Occlusal adjustment					0.557
Never	28 (16.7%)	19 (67.9%)	8 (28.6%)	1 (3.6%)	
Sometimes	107 (63.7%)	84 (78.5%)	20 (18.7%)	3 (2.8%)	
Often	30 (17.9%)	22 (73.3%)	8 (26.7%)	0 (0.0%)	
Unanswered	3 (1.8%)				
Local antibiotics					0.205
Never	101 (60.1%)	80 (79.2%)	19 (18.8%)	2 (2.0%)	
Sometimes	52 (31.0%)	38 (73.1%)	12 (23.1%)	2 (3.8%)	
Often	13 (7.7%)	7 (53.8%)	6 (46.2%)	0 (0.0%)	

Unanswered 2
(1.2%)

Table 6 Continued

		Number of patients per week referred to a periodontist				
		0-3	4-10	>10		
<i>Periodontal services offered</i>	N = 168	N =126	N =38	N =4		p-value*
	N (%)	N (%)	N (%)	N (%)		
Systemic antibiotics						0.156
Never	86 (51.2%)	61 (70.9%)	21 (24.4%)	4 (4.7%)		
Sometimes	76 (45.2%)	62 (81.6%)	14 (18.4%)	0 (0.0%)		
Often	5 (3.0%)	3 (60.0%)	2 (40.0%)	0 (0.0%)		
Unanswered	1 (0.6%)					
Osseous/flap surgery						0.170
Never	142 (84.5%)	108 (76.1%)	31 (21.8%)	3 (2.1%)		
Sometimes	21 (12.5%)	17 (81.0%)	4 (19.0%)	0 (0.0%)		
Often	2 (1.2%)	0 (0.0%)	2 (100.0%)	0 (0.0%)		
Unanswered	3 (1.8%)					
Treatment of failing implant						0.245
Never	146 (86.9%)	110 (75.3%)	33 (22.6%)	3 (2.1%)		
Sometimes	19 (11.3%)	15 (78.9%)	3 (15.8%)	1 (5.3%)		
Often	1 (0.6%)	0 (0.0%)	1 (100.0%)	0 (0.0%)		
Unanswered	2 (1.2%)					
Laser-assisted periodontal therapy						0.184
Never	134 (79.8%)	102 (76.1%)	29 (21.6%)	3 (2.2%)		
Sometimes	25	20	4	1		

	(14.9%)	(80.0%)	(16.0%)	(4.0%)
Often	7	3	4	0
	(4.2%)	(49.2%)	(57.1%)	(0.0%)
Unanswered	2			
	(1.2%)			

*Calculated using Fisher's Exact test

Only 5% of responding dentists report that they never perform scaling and root planing. Practices that say that they often perform scaling and root planing refer more patients to periodontists ($p < 0.001$).

Most offices (82%) provide occlusal adjustment. Only 39% of responders stated that they use local antibiotics. About half (48%) of the dentists revealed that they use systemic antibiotics to treat periodontal infections. Most dentists never perform osseous/flap surgery (85%) or treat failing implants (86.9%). Few dentists (19%) disclosed that they use some type of laser-assisted periodontal therapy. None of the surgical treatment rendered variables were significantly associated with number of patients referred to a periodontist. (Table 6)

Periodontal treatment philosophy was further evaluated by asking responders what they considered when making a periodontal referral. A Likert scale was utilized to show how responders agreed or disagreed about considerations made when referring to a periodontist. Table 7 presents this data stratified by number of patients per week referred to a periodontist.

TABLE 7

WHAT RESPONDERS CONSIDER WHEN MAKING A PERIODONTAL
REFERRAL AND NUMBER OF REFERRALS MADE

<i>Consideration when making a periodontal referral</i>	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
I take the periodontal practice location into consideration.					0.293
Strongly disagree	20 (11.9%)	15 (75.0%)	3 (15.0%)	2 (10.0%)	
Disagree	122 (72.6%)	92 (75.4%)	28 (23.0%)	2 (1.6%)	
Agree	24 (14.3%)	18 (75.0%)	6 (25.0%)	0 (0.0%)	
Strongly agree	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Unanswered	2 (1.2%)				
I take my personal relationship with the periodontist into consideration (ex. friendship, personal interactions like lunches).					>0.999
Strongly disagree	16 (9.5%)	12 (75.0%)	4 (25.0%)	0 (0.0%)	
Disagree	45 (26.8%)	34 (75.6%)	10 (22.2%)	1 (2.2%)	
Agree	72 (42.9%)	54 (75.0%)	16 (22.2%)	2 (2.8%)	

Strongly disagree	33 (19.6%)	25 (75.8%)	7 (21.2%)	1 (3.0%)
Unanswered	2 (1.2%)			

Table 7 Continued

<i>Consideration when making a periodontal referral</i>	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
I consider the clinical outcomes of previous patients from that periodontist.					0.770
Strongly disagree	6 (3.6%)	4 (66.7%)	2 (33.3%)	0 (0.0%)	
Disagree	0 (0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Agree	71 (42.3%)	53 (74.6%)	17 (23.9%)	1 (1.4%)	
Strongly agree	90 (53.6%)	69 (76.7%)	18 (20.0%)	3 (3.3%)	
Unanswered	1 (0.6%)				
I consider how patients have perceived their care from that periodontist (ex. chairside manner, office staff interactions).					0.405
Strongly disagree	5 (3.0%)	3 (60.0%)	2 (40.0%)	0 (0.0%)	
Disagree	3 (1.8%)	2 (66.7%)	1 (33.3%)	0 (0.0%)	
Agree	69 (41.1%)	49 (71.0%)	19 (27.5%)	1 (1.4%)	

Strongly agree	89 (53.0%)	71 (79.8%)	15 (16.9%)	3 (3.4%)
Unanswered	2 (1.2%)			

Table 7 Continued

<i>Consideration when making a periodontal referral</i>	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
I like to treat periodontal disease in my office.					0.787
Strongly disagree	10 (6.0%)	9 (90.0%)	1 (10.0%)	0 (0.0%)	
Disagree	30 (17.9%)	25 (83.3%)	5 (16.7%)	0 (0.0%)	
Agree	98 (58.3%)	71 (72.4%)	23 (23.5%)	4 (4.1%)	
Strongly agree	27 (16.1%)	20 (74.1%)	7 (25.9%)	0 (0.0%)	
Unanswered	3 (1.8%)				
I am concerned that if I refer to a periodontist my patient will not be returned to my office in a timely manner.					0.858
Strongly disagree	41 (24.4%)	30 (73.2%)	11 (26.8%)	0 (0.0%)	
Disagree	100 (59.5%)	75 (75.0%)	21 (21.0%)	4 (4.0%)	
Agree	17 (10.1%)	13 (76.5%)	4 (23.5%)	0 (0.0%)	
Strongly agree	8 (4.8%)	7 (87.5%)	1 (12.5%)	0 (0.0%)	
Unanswered	2 (1.2%)				

Table 7 Continued

<i>Consideration when making a periodontal referral</i>	Number of patients per week referred to a periodontist				p-value*
	N = 168 N (%)	0-3 N =126 N (%)	4-10 N =38 N (%)	>10 N =4 N (%)	
I do not refer patients who cannot afford periodontal treatment.					0.165
Strongly disagree	36 (21.4%)	29 (80.6%)	7 (19.4%)	0 (0.0%)	
Disagree	102 (60.7%)	74 (72.5%)	25 (24.5%)	3 (2.9%)	
Agree	23 (13.7%)	20 (87.0%)	3 (13.0%)	0 (0.0%)	
Strongly agree	5 (3.0%)	2 (40.0%)	2 (40.0%)	1 (20.0%)	
Unanswered	2 (1.2%)				
I am interested in obtaining periodontal consultations via teledentistry by video-conferencing with a periodontist.					0.032
Strongly disagree	20 (11.9%)	16 (80.0%)	4 (20.0%)	0 (0.0%)	
Disagree	87 (51.8%)	64 (73.6%)	22 (25.3%)	1 (1.1%)	
Agree	53 (31.5%)	43 (81.1%)	8 (15.1%)	2 (3.8%)	
Strongly agree	5 (3.0%)	1 (20.0%)	3 (60.0%)	1 (20.0%)	
Unanswered	3 (1.8%)				

*Calculated using Fisher's Exact test

Only 14% of responders agreed that they take into account the periodontal office location when making a referral to a periodontist. The majority agreed (43%) or strongly agreed (20%) that they take their personal relationship with the periodontist into consideration when making referrals. Almost all of the surveyed dentists agree (42%) or strongly agree (54%) that they consider the clinical outcomes of previous patients when referring to a periodontist. Most of the dentists agreed (41%) or strongly agreed (53%) that how patients perceived their care from the periodontist was considered when referring to that periodontist. None of the periodontal treatment philosophy variables were significantly associated with number of patients per week referred to a periodontist.

Most surveyed dentists stated that they like to treat periodontal disease in their offices, with 58% agreeing and 16% strongly agreeing with that statement. Only a few dentists (16%) are concerned about a patient not returning to their office after a periodontal referral. Most of the respondents disagreed (61%) or strongly disagreed (21%) with the statement: “I do not refer patients who cannot afford periodontal treatment.” When the possibility of remote periodontal consultations via teledentistry was presented, 34% of the dentists expressed interest in the idea. Dentists that referred fewer patients to periodontists were more likely to express interest in the idea of remote consultations with a periodontist ($p = 0.032$). (Table 7)

CHAPTER 4

DISCUSSION

In this investigation, three domains of interest were probed to see if those areas were correlated with periodontal referral patterns. Details of the three broad independent variables: clinician demographics, practice location and characteristics, and periodontal treatment philosophy were evaluated by surveying general dentists in Kansas and Missouri.

Clinician Demographics

The genders that respondents reported (70% male, 29% female) are fairly consistent with the American Dental Association's data, reporting that 76% of Kansas dentists are male and 23% are female while 77% of Missouri dentists are male and 22% are female (Kaiser 2016). While not statistically significant, it appeared that a higher percentage of female dentists responded compared to what would be expected in a random sample. While most male and female dentists reported referring 0-3 patients to a periodontist in a week, gender did not appear to influence the number of periodontal referrals made. This is in contrast to a previous study which found that women clinicians were more likely to refer than their male counterparts (Zemanovich et al. 2006). However, the previous study focused on Virginian dentists, so there may be other contributing factors in how their male and female dentists practice compared to those in Kansas and Missouri.

With over 65% of respondents out of dental school for more than 20 years, it is logical that the majority of respondents (72%) reported less than \$10,000 in dental school debt. The most dental school debt appeared to be among the more recent graduates. Neither year of graduation nor student debt was correlated with periodontal referrals. It has been suggested that those with significant student debt would be less likely to refer because of the potential loss of profit from sharing a patient; however, this data does not support that assumption.

Together, Kansas and Missouri have a total of 4,714 dentists, 2819 of whom are members of the KDA or MDA (Kaiser 2016). As of April 2016, Kansas has 1,576 professionally active dentists while Missouri has over double that at 3,138 professionally active dentists (Kaiser 2016). Even with Missourians having twice as many dentists as Kansans, Missouri dentists only accounted for 39% of respondents while Kansas dentists were 60% of responders. The difference in response rate is likely due to how the surveys were delivered to respondents. The KDA allowed the surveys to be distributed via their member list-serv while the MDA posted the survey link in their monthly e-newsletter and on their Facebook® page. Therefore, it appeared that distributing surveys via e-mail is more likely to gain responses than when posted passively on social media or in a newsletter. State of practice did not influence periodontal referrals.

Practice Location and Characteristics

Dentists who practice by themselves are less likely to refer than those who practice with at least one other dentist (Table 4). This finding is consistent with a previous investigation in Virginia (Zemanovich et al. 2006). Therefore, this trend appears to be generalized across multiple geographic areas. Dentists who practice

together may share similar treatment philosophies and may be more inclined to refer patients who are in need of periodontal intervention. Dentists in solo practices are more likely to function as “jack of all trades,” keeping most dental work for their patients in-house.

One may hypothesize that perhaps the reason more dentists in group practices refer is because more patients are being seen in those larger practices or the offices may be located in more urban settings, closer to periodontists. More solo practices exist in rural areas. However, the data does not support this theory, as neither practice location nor patients seen per week influenced periodontal referrals. Almost half the dentists surveyed reported seeing over 80 patients weekly, but seeing more patients did not correlate with referring more patients. One may also think that group practices are more likely located in urban settings within close proximity to a periodontist. However, population density nor distance to a periodontist affected how many patients were referred. Therefore, it seems more likely that practice philosophy alignment is one of the factors in the increasing referrals seen from group practices.

Additionally, those practices that include endodontists or prosthodontists are also more likely to refer (Table 4). Again, this could be related to practice philosophy. Those offices with specialists in-house already have a culture of the team dental approach. However, this data must be interpreted with caution, as there were only five responders with in-house endodontists and two responders with in-house prosthodontists. Nevertheless, referring to a periodontist seemed to be more aligned with the practice climate.

The majority of offices stated that they employed more than two hygienists (60%). Dentists who had more hygienists reported referring more patients to the periodontist ($p=0.020$). This finding is consistent with a previous study in Virginia, suggesting that this finding may be generalizable (Zemanovich et al. 2006).

Only 24% of survey responders reported being a totally fee-for-service office while 76% reported accepted insurance as a form of payment. Previous studies had shown that insurance patients were more likely to be referred (Lee et al. 2009; Bennett et al. 2010). However, this data did not show any difference in referrals from dentists that were either fee-for-service or participated in insurance plans, regardless of the type of insurance accepted.

Periodontal Treatment Philosophies

To evaluate periodontal treatment philosophy, several aspects were assessed. Clinical judgement, periodontal services offered and at what frequency, considerations when making a periodontal referral, and personal feelings regarding periodontal disease and its treatment were investigated.

Most responding dentists (54%) stated that they would recommend periodontal surgery when the patient has 6-7 mm probing depths. Similarly, 67% would refer a patient to a periodontist when the patient has 6-7 mm probing depths. According to Lindhe, a probing depth of 5.5 mm and beyond will likely benefit from periodontal surgery, so most dentists report referring at appropriate times (Lindhe 1982). While most dentists report referring at appropriate diagnostic times, the number of referrals actually made does not reflect this. With periodontitis affecting 47% of patients over 30 years of age, it would be expected that dentists would refer almost half of their adult patients to

periodontists (Eke et al. 2012). However, most survey responders reported seeing over 80 patients a day yet only referring 0-3 patients to a periodontist per week. It is likely that general dentists understand when it is appropriate to make a referral, yet for some reason, they are not exercising that clinical judgement in practice. This disconnect between knowledge and applied skills is consistent with what Williams found with dental and dental hygiene students (Williams et al. 2014). Unfortunately, it does not appear that this lack of application improves with dental experience.

Scaling and root planing was associated with increased periodontal referrals ($p < 0.000$). If offices are providing phase I periodontal treatment such as scaling and root planing, they are likely monitoring patients' periodontal progress. Typically, when a patient does not respond well to scaling and root planing or if there are residual defects, the patient may be referred to a periodontist. Therefore, it is logical that those offices who perform scaling and root planing are referring more patients to periodontists.

Few dentists reported performing periodontal surgical procedures (14%); however, offering those periodontal services did not affect periodontal referrals. One would expect that if patients' periodontal needs are being managed by the general dentist with surgical intervention, then they would refer less. However, the data does not support this theory. Similar findings were shown with treatment of failing implants and laser-assisted periodontal therapy. Again, if those periodontal needs are being met, one would expect less referrals. However, the number of referrals for this category may be too low to show a decrease.

When evaluating what considerations dentists have when making a periodontal referral, a few key points surfaced. Most dentists stated that the periodontal practice

location is not important when making a referral. This suggests that dentists do not simply refer because a periodontist is close but instead are more fastidious in to whom they refer. Additionally, most responders agree that the personal relationship with the periodontist, the clinical outcomes of previous patients from that periodontist, and how patients perceived their care from that periodontist are all contributing factors when deciding to make a referral. Therefore, not only is clinical success important for a general dentist, but also the perception of care from the patient referred. Periodontists should consider this factor when seeing patients from a new referral. Additionally, periodontists need to foster their personal relationships with referring dentists, as this is also a critical factor to how general dentists refer.

Clinical Implications

While this study focused on general dentists practicing in Kansas and Missouri, there are several components which could be applied broadly. For example, several of the findings have been demonstrated in other geographic areas such as Virginia, so that strengthens the argument that these implications could be generalized.

Dentists are more likely to refer to periodontists if they practice with at least one other dentist ($p=0.001$). This finding is consistent with other studies and appears to be independent of patients seen per week, practice location, or proximity to nearest periodontist. The inclination of dental professionals practicing with other clinicians to refer more is likely due to the team dynamics. Dentists are likely to practice with one another if they share similar practice philosophies. There could be a number of reasons why dentists practicing alone may be less likely to refer. They may not understand what services a periodontist could provide to their patients or there could be other

misunderstandings such as the proper timing of a successful periodontal referral.

Therefore, more education and outreach from periodontists should be focused at single doctor practices.

Additionally, dentists are more apt to refer if they work with more than one hygienist ($p=0.020$), a finding consistent with other regional studies. Dental hygienists are an underappreciated part of the dental team. They are trained to hone in on a patient's periodontal health. Oftentimes, patients will see their hygienists more than their dentists. Therefore, a hygienist has the potential to be a crucial part of the dental team. They are able to monitor patients for periodontal breakdown and make recommendations to their supervising dentists on when to refer to the periodontist. Periodontists would be wise to broaden their referral base to include hygienists. Targeting hygienists through study clubs or continuing education presentations are promising strategies to increase referrals from offices with hygienists. Additionally, offices which often perform scaling and root planing refer more than offices which never or seldom provide this service ($p<0.000$). Hygienists are usually the clinicians performing the scaling and root planing, so this findings fits well with the discovery that offices with more hygienists refer more.

Interest in teledentistry is also correlated with periodontal referrals. One of the potential barriers to periodontal care is the amount of visits necessary for a patient. For example, a patient often has an initial evaluation before any procedures are completed, and this is followed by post-operative care and maintenance as needed. Periodontists are primarily located in urban areas; thus, patients may travel significant distances to be seen. This patient time investment may dissuade general dentists from referring to periodontists, knowing that the patient may not be willing to commit to the travel

necessary. However, conferencing remotely is an emerging medical option (Rocca et al. 1999; Khan and Omar 2013). Teledentistry has shown promise and may allow a periodontist to remotely perform a consultation with a general dentist to save the potential patient travel time. Dentists who expressed interest in teledentistry as a means to obtain periodontal consultations referred less than those who were not interested ($p=0.032$). Therefore, if those general dentists had the ability to utilize teledentistry, their referrals to periodontists may increase. In Missouri, currently a bill is being presented for the use of teledentistry (2016). Female dentists in Missouri were among the most interested in teledentistry (Appendix E). Therefore, as the number of female dentists continues to rise and teledentistry gains traction in Missouri, there may be an increase in the number of referrals to periodontists via teledentistry (Fox 2012).

Study Limitations

The study design itself has limitations. Electronic surveys were distributed to members of the Kansas Dental Association and the Missouri Dental Association (see figure 1). The KDA and MDA list a combined amount of 2,819 members. 221 responses were recorded. While this is seemingly an 8% response rate, it is likely higher. Members of the KDA and MDA are not only practicing general dentists to whom the survey was directed; there are also inactive members, specialists, and students. Therefore, the data regarding actual response rate cannot be determined accurately. Additionally, while data from online surveys appears to generate more complete responses than traditional paper-and-pencil surveys, there is also typically a lower response rate (Kongsved et al. 2007). This is likely due to lack of comfortability with technology, which may be more common

with clinicians who practice in rural areas. Therefore, this particular method of eliciting responses may not have targeted those clinicians.

Members of the KDA responded at a higher frequency than members of the MDA. This is probably due to the way surveys were distributed. The KDA allowed surveys to be e-mailed to their members while the MDA posted the survey on their Facebook® page and included a link in their monthly e-newsletters. Therefore, it is clear that for future studies, a more active way to reach potential respondents will provide a higher response rate. This is not so much a limitation but rather an opportunity for future studies.

Future Studies

Teledentistry is an emerging modality to reach patients who may have challenges in obtaining care. Patients have geographic or time constraints which make seeing a periodontist challenging. However, teledentistry is an option to obtain consultations and perhaps post-operative care without the burden of traveling for the patient. This idea is becoming popular nationwide. For example, California's state legislature recently passed legislation requiring Medicaid to cover teledentistry services (Rabinowitz 2016). Currently, there is a bill being presented in the Missouri House of Representatives proposing utilizing teledentistry (2016). Teledentistry has great potential for reaching patients in dental deserts where the closest dentist is over 30 minutes of travel time a way and the closest periodontist likely hours away (Kimminau and Wellever 2011). Therefore, pilot studies evaluating the utility and practicality of teledentistry for periodontal care have great potential for future studies.

CHAPTER 5

CONCLUSIONS

Within the limitations of this study, the following conclusions may be drawn:

1. General dentist demographics, such as gender, student debt, periodontal continuing education, and year of dental school graduation, do not influence referrals to periodontists.
2. Practice location and characteristics affect periodontal referral patterns. In particular, dentists who practice one at least one other dentist and/or at least one hygienist are more likely to refer to a periodontist.
3. Periodontal treatment philosophies guide periodontal referral patterns. Offices that frequently provide scaling and root planing are more apt to refer to periodontists. Additionally, dentists who are interest in obtaining consultations via teledentistry reported referring less with the implication that if teledentistry were available, those referrals would increase.

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APPENDIX A

IRB Approval Letter

NOTICE OF EXEMPT DETERMINATION

Principal Investigator: Mary Walker
00251 DS Oral Bio
Kansas City, MO 64109

Protocol Number: 15-094
Protocol Title: SURVEY OF KANSAS AND MISSOURI GENERAL DENTISTS IDENTIFYING PERIODONTAL REFERRAL PATTERNS
Type of Review: Exempt

Date of Determination: 04/02/2015

Dear Dr. Walker,

The above referenced study was reviewed and determined to be exempt from IRB review and approval in accordance with the Federal Regulations 45 CFR Part 46.101(b).

The above referenced study was determined to be exempt in accordance with the Federal Regulations 45 CFR Part 46.101(b)(2) as follows: "Research involving the use of educational tests (cognitive, diagnostic, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation".

This determination includes the following documents:

Attachments

- UMKC Gift Card Program Approval Form_141204_FINAL
- Survey Request for MDA
- Reminder Email for KDA
- SurveyForGeneralDentists
- Prompting Email for KDA
- Survey Email for KDA

You are required to submit an amendment request for all changes to the study, to prevent withdrawal of the exempt determination for your study. When the study is complete, you are required to submit a Final Report.

Please contact the Research Compliance Office (email: umkcirb@umkc.edu; phone: (816)235-5927) if you have questions or require further information.

Thank you,

Simon MacNeill
UMKC IRB

APPENDIX B

Survey

Patterns)

You are being asked to participate in a survey done for research purposes.

This survey is being conducted to identify patterns of general dentists' perspective on periodontal treatment and referrals.

The survey should take approximately 10 minutes to complete. If you decide to participate in this survey, your participation is anonymous, confidential and voluntary. If you choose not to participate or to withdraw from the online study at any time, you may do so without penalty or loss of benefit to yourself. The results of the survey may be published, but your identity will remain confidential.

In this research, there are no foreseeable risks to you in completing the survey. No identifying marker will be linked to your survey response. Although there is no direct benefit to you, your participation will provide data that will facilitate and enhance care for patients with periodontal disease.

If you have any questions concerning the survey, you may contact Dr. Cassandra McKenzie at mckenziecass@umkc.edu.

If you have any questions regarding your rights as a research participant, you may contact the UMKC IRB at 816-235-5927.

Gender

- male
 female

Year of dental school graduation

(Please type in year (example: 1992))

How many hours do you work in an average week?

- < 25
 25-32
 33-40
 >40

In which state do you primarily practice?

- Kansas
 Missouri
 Kansas and Missouri

04/24/2015 2:31pm

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Indicate your training.

- DDS/DMD
 - AEGD (Advanced Education in General Dentistry)
 - GPR (General Practice Residency)
 - Dental specialty
 - Military
 - Other
- (You may select more than one option.)

In which dental specialty are you trained?

- Dental Public Health
 - Endodontics
 - Oral and Maxillofacial Pathology
 - Oral and Maxillofacial Radiology
 - Oral and Maxillofacial Surgery
 - Orthodontics and Dentofacial Orthopedics
 - Pediatric Dentistry
 - Periodontics
 - Prosthodontics
- (You may select more than one option.)

Do you practice in your specialty?

- Yes
- No

Describe your advanced training.

How many hours of continuing education do you obtain annually?

- Minimum required
- Slightly above the minimum required (1-10 additional CE hours)
- Significantly above the minimum required (>10 additional CE hours)

Are you active in a study club?

- Yes
- No

How much dental school debt do you have currently?

- < \$10,000
- \$10,000-100,000
- \$100,000-250,000
- > \$250,000

How many dentists including yourself are in your practice?

- 1
 - 2
 - 3 or more
- (Please include dentists and dental specialists who practice in your office.)

How many full time or full time equivalent dental hygienists are in your practice?

- 0
 - 1
 - 2 or more
- (For example, two part time hygienists would equal one full time equivalent hygienist.)

Please indicate any dental specialists who practice full time or part time in your office.

- Endodontist
 - Oral and Maxillofacial Pathologist
 - Oral and Maxillofacial Radiologist
 - Oral and Maxillofacial Surgeon
 - Orthodontist
 - Pediatric Dentist
 - Periodontist
 - Prosthodontist
- (You may select more than one option.)

How many patients do you and your hygienist(s) see per week in practice?

- < 40
 - 41-60
 - 61-80
 - >80
- (Please include patients seen by your hygienist.)

What is the location of your practice?

- Urbanized area (>50,000 residents)
 - Urbanized cluster (2,500-50,000 residents)
 - Rural (< 2,500 residents)
- (As defined by the United States Census Bureau)

What is the distance between your office and the nearest periodontist?

- < 10 miles
- 10-30 miles
- >30 miles
- don't know

Is your practice 100% fee-for-service?

- Yes
- No

Indicate the insurance plans you accept.

- Direct Reimbursement
- Indemnity Plans ("Traditional" Insurance)
- Preferred Provider Organization (PPO)
- Dental Health Maintenance Organization (DHMO)
- Medicare/Medicaid

Do you refer to a periodontist?

- Yes
- No

How many patients do you typically refer to a periodontist in a month for periodontal therapy?

- 0-3
 - 4-10
 - >10
- (Do not include patients referred for implants or soft tissue grafting.)

To how many different periodontal practices do you refer?

- 1
- 2
- 3 or more

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Consider your periodontal treatment philosophy, noting that there are no wrong answers. At what probing depth would you consider the following interventions:

	4-5 mm	6-7 mm	8-9 mm	>10 mm
Recommend periodontal surgery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refer to a periodontist	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often do you provide the following periodontal services in your practice?

	Never	Sometimes (1-5 times/week)	Often (>5 times/week)
Scaling and root planing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Occlusal adjustment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of local antibiotics (ex. Arestin(R)/minocycline)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of systemic antibiotics to treat periodontal disease (ex. metronidazole, doxycycline)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flap/osseous surgery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Treatment of failing implant (peri-mucositis or peri-implantitis)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Laser-assisted periodontal therapy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how you agree or disagree with the following statements when considering making a referral to a periodontist.

	strongly disagree	disagree	agree	strongly agree
I take the periodontal practice location into consideration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I take my personal relationship with the periodontist into consideration (ex. friendship, personal interactions like lunches).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consider the clinical outcomes of previous patients from that periodontist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consider how patients have perceived their care from that periodontist (ex. chairside manner, office staff interactions).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how you would agree or disagree with the following statements.

	strongly disagree	disagree	agree	strongly agree
I like to treat periodontal disease in my office.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned that if I refer to a periodontist my patient will not be returned to my office in a timely manner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not refer patients who cannot afford periodontal treatment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am interested in obtaining periodontal consultations via teledentistry by video-conferencing with a periodontist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Optional: please add any comments that could provide additional information about your referral process and periodontal treatment philosophy.

(optional)

APPENDIX C

KDA email text:

Prompting e-mail

Survey e-mail

Reminder e-mail

Prompting E-mail

Dear Doctor:

On behalf of the KDA, we would appreciate your help with a UMKC master student's thesis.

Dr. Cassandra McKenzie's thesis project is focused on educational research related to periodontal treatment and referrals. The survey you will receive shortly should take less than 10 minutes to complete, and the results will help to improve comprehensive care for patients in Kansas.

Thank you in advance for your time and your assistance. Please look for the next email with the survey link.

Best,

[Membership Manager of the KDA]

Survey E-mail

Dear Doctor:

My name is Cassandra McKenzie, a graduate student in the MS program in Oral and Craniofacial Sciences at UMKC. My thesis project is focused on educational research related to periodontal treatment and referrals. As you know, the majority of adults have periodontal disease. However, treatment and referrals may be dependent on several factors. To get a better understanding of such factors, I would appreciate if you could complete a brief survey about your practice, background, and periodontal treatment philosophy. This information will be used to identify patterns of general dentists' perspective on periodontal treatment and referrals.

This survey will take approximately 10 minutes to complete, and you can be entered to win a \$50 giftcard to Amazon.com. The information you provide will be kept strictly confidential and will be used to facilitate and enhance care for patients with periodontal disease.

Please complete this survey by [10 days from emailed date].

Thank you in advance for your time and your assistance with my project.

Best,

Cassandra McKenzie, MA, DDS

Reminder E-mail

Dear Doctor:

My name is Cassandra McKenzie, a graduate student in the MS program in Oral and Craniofacial Sciences at UMKC. You should have already received at least one email from me requesting your help with my thesis project which is focused on educational research related to periodontal treatment and referrals.

This survey will take approximately 10 minutes to complete, and you can be entered to win a \$50 giftcard to Amazon.com. The information you provide will be kept strictly confidential and will be used to facilitate and enhance care for patients with periodontal disease.

If you have not completed the online survey, please do so by [10 days from current date].

Thank you in advance for your time and your assistance with my project.

Best,

Cassandra McKenzie, MA, DDS

APPENDIX D

MDA Survey Request

On behalf of the MDA, we would appreciate your help with a UMKC master student's thesis. Dr. Cassandra McKenzie's thesis project is focused on educational research related to periodontal treatment and referrals. The online survey should take less than 10 minutes to complete, and the results will help to improve comprehensive care for patients in Missouri. Respondents can enter to win a \$50 Amazon.com giftcard. Here is the survey link: [xxx.xxx]. Thank you!

APPENDIX E

Demographic Stratification of Periodontal Treatment Philosophy

I consider practice location when making a periodontal referral							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=97	Male N=70	<10	2	5	2	0	
		11-20	0	4	0	0	
		21-30	0	2	7	8	
		>30	5	28	7	0	
	Female N=27	<10	2	12	0	0	
		11-20	1	1	2	0	
		21-30	0	5	1	0	
		>30	0	2	1	0	
	Missouri N=63	Male N=43	<10	1	4	0	0
			11-20	0	3	1	0
			21-30	2	9	0	0
		Female N=20	>30	2	17	4	0
<10			1	6	3	0	
11-20			0	4	0	0	
		21-30	2	3	0	0	
		>30	0	1	0	0	

I consider my personal relationship with the periodontist when making a periodontal referral							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=89	Male N=62	<10	0	1	7	1	
		11-20	0	1	3	0	
		21-30	0	2	7	8	
		>30	5	10	17	0	
	Female N=27	<10	2	4	6	2	
		11-20	3	1	0	0	
		21-30	0	0	2	4	
		>30	0	0	3	0	
	Missouri N=63	Male N=43	<10	0	2	2	1
			11-20	0	0	2	2
			21-30	2	2	5	2
		Female N=20	>30	2	10	7	4
<10			0	4	6	0	
11-20			0	2	1	1	
		21-30	1	1	1	2	

>30	1	0	0	0
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I consider previous patient clinical outcomes when making a periodontal referral							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=99	Male N=71	<10	0	0	7	2	
		11-20	0	0	2	2	
		21-30	0	0	5	12	
		>30	2	0	21	18	
	Female N=28	<10	1	0	6	7	
		11-20	1	0	0	3	
		21-30	0	3	2	1	
		>30	0	0	1	2	
	Missouri N=63	Male N=43	<10	0	0	1	4
			11-20	0	0	2	2
			21-30	2	0	6	3
		Female N=20	>30	0	0	7	16
<10			0	0	4	6	
11-20			0	0	1	3	
		21-30	0	0	2	3	
		>30	0	0	1	0	

I consider patients' perceived care when making a periodontal referral							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=97	Male N=70	<10	0	0	7	2	
		11-20	0	0	1	3	
		21-30	0	1	6	10	
		>30	1	0	21	18	
	Female N=27	<10	1	0	7	6	
		11-20	1	0	1	2	
		21-30	0	0	1	5	
		>30	0	0	0	3	
	Missouri N=48	Male N=28	<10	0	0	1	4
			11-20	0	0	2	2
			21-30	2	1	5	3
		Female N=20	>30	0	1	7	0
<10			0	0	4	6	
11-20			0	0	1	3	
		21-30	0	0	2	3	

>30	0	0	1	0
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State	Gender	Years since graduation	I like to treat periodontal disease in office				
			Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=91	Male N=64	<10	0	1	5	4	
		11-20	0	0	2	2	
		21-30	2	4	10	1	
		>30	3	13	22	5	
	Female N=27	<10	1	1	10	2	
		11-20	1	0	2	1	
		21-30	0	1	4	1	
		>30	0	0	3	0	
	Missouri N=65	Male N=44	<10	0	0	2	3
			11-20	0	0	3	1
			21-30	1	1	5	4
			>30	2	5	17	0
Female N=21		<10	0	2	6	3	
		11-20	0	1	3	0	
		21-30	0	0	4	0	
		>30	0	0	2	0	

State	Gender	Years since graduation	I am concerned that if a refer to a periodontist I will not see the patient again				
			Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=100	Male N=74	<10	2	7	0	1	
		11-20	2	2	0	0	
		21-30	5	7	4	1	
		>30	11	26	6	0	
	Female N=26	<10	1	11	1	1	
		11-20	2	2	0	0	
		21-30	0	5	1	0	
		>30	2	1	0	0	
	Missouri N=67	Male N=46	<10	2	2	0	1
			11-20	1	2	1	0
			21-30	4	7	0	0
			>30	6	16	2	2
Female N=21		<10	1	8	2	0	
		11-20	0	2	1	1	
		21-30	1	2	0	1	

>30	1	1	0	0
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I do not refer patients that cannot afford periodontal treatment							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=92	Male N=65	<10	1	8	1	0	
		11-20	1	4	0	0	
		21-30	4	1	2	0	
		>30	11	21	9	2	
	Female N=27	<10	2	10	2	0	
		11-20	1	3	0	0	
		21-30	0	6	0	0	
		>30	2	1	0	0	
	Missouri N=65	Male N=46	<10	3	0	2	0
			11-20	1	3	0	0
			21-30	4	6	1	0
		Female N=21	>30	4	17	2	3
<10			1	5	4	1	
11-20			0	4	0	0	
		21-30	2	2	0	0	
		>30	0	1	1	0	

I am interest in obtaining consults by teledentistry							
State	Gender	Years since graduation	Strongly disagree	Disagree	Agree	Strongly agree	
Kansas N=102	Male N=75	<10	2	5	3	0	
		11-20	1	0	3	1	
		21-30	2	5	10	0	
		>30	6	27	10	0	
	Female N=27	<10	2	7	5	0	
		11-20	2	1	1	0	
		21-30	1	4	1	0	
		>30	0	2	1	0	
	Missouri N=45	Male N=45	<10	1	1	3	0
			11-20	1	2	1	0
			21-30	0	6	5	0
		Female N=21	>30	3	17	3	2
<10			1	5	5	0	
11-20			0	3	1	0	
		21-30	0	2	1	1	

>30 1 0 1 0

VITA

NAME

Cassandra Collins McKenzie

DATE AND PLACE OF BIRTH

October 19, 1983, Lincoln, NE

EDUCATION

5/2002	Diploma	Sabetha High School Sabetha, Kansas
5/2006	BS	University of Kansas Lawrence, Kansas
6/2008	MA	Johns Hopkins University School of Education Baltimore, Maryland
5/2014	DDS	University of Illinois at Chicago College of Dentistry Chicago, IL
5/2017	MS	University of Missouri-Kansas City School of Dentistry Kansas City, MO

INTERNSHIP AND/OR RESIDENCIES

2014-2016	Periodontics Residency	University of Missouri-Kansas City School of Dentistry Kansas City, Missouri
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AWARDS AND ACHIEVEMENTS

- Preparing Future Faculty Scholar, UMKC School of Graduate Studies, 2016
- Omicron Delta Kappa, Honor Society, 2015

- UMKC School of Dentistry Predoctoral Periodontics Study Club, Founder/President, 2015
- American Academy of Periodontology Foundation Student Ambassador, 2015
- Omicron Kappa Upsilon, National Dental Honor Society, Sigma Chapter, 2014
- Illinois Academy of General Dentistry Senior Case Presentation Winner, 2014
- American Academy of Periodontology Dental Student Award, 2014
- Harry J. Bosworth Company CaseCAT Runner-Up for Oral Presentation, 2013
- Da Vinci Clinic CaseCAT Oral Presentation Winner, 2013
- Health Professionals Student Council Travel Grant Recipient for Dental Research, 2011, 2013
- UIC Clinic and Research Day Predoctoral Student Award in Clinical Science, 2012
- ADA Foundation Dental Students' Conference on Research Delegate for UIC, 2011
- Dr. Isaac Schour Memorial Dentistry Student Research Award, 2010
- AmeriCorps Education Award for Service in the Classroom, 2007-2008
- Teach For America Baltimore Corps Member (17% acceptance nationwide), 2006-2008
- National Science Foundation National Youth Science Camp Delegate for Kansas, 2002

PROFESSIONAL ORGANIZATIONS

American Academy of Periodontology
 American Dental Education Association
 Midwest Society of Periodontology
 Omicron Kappa Upsilon, National Dental Honor Society

PUBLICATIONS

Pyter L, Yang L, McKenzie CC, Rocha JM, Carter CS, Cheng B, Engeland CG.
 Contrasting mechanisms by which social isolation and restraint impair healing in male mice. *Stress*. 2014 May; 19(3): 256-265.