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MINNESOTA DENTISTS' OPINION OF THE DENTAL THERAPY WORKFORCE MODEL

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Marguerite J. Rogers

Candidate

Dental Medicine

Department

This thesis is approved, and it is acceptable in quality and form for publication:

Approved by the Thesis Committee:

Christine Nathe, RDH, MS, Chairperson

Christina Calleros, RDH, MS

Lindsey M. Lee, RDH, MS

**MINNESOTA DENTISTS' OPINION OF THE DENTAL THERAPY
WORKFORCE MODEL**

By

MARGUERITE J. ROGERS

B.S., Behavioral Science, United States Air Force Academy, 1989
A.S., Dental Hygiene, Armstrong Atlantic State University, 2007

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

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Dental Hygiene**

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May, 2018

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MODEL

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MARGUERITE J. ROGERS

B.S., Behavioral Science, United States Air Force Academy, 1989

A.S., Dental Hygiene, Armstrong Atlantic State University, 2007

M.S., Dental Hygiene, The University of New Mexico, 2018

ABSTRACT

The state of Minnesota developed the dental therapy workforce model to help alleviate the disparity in access to dental care. Despite success in other countries and acceptance by other professional organizations in the United States, some dentists continue to oppose this workforce model. The purpose of this study was to quantify Minnesota dentists' attitudes regarding the utilization of dental therapists in that state. A survey was constructed that queried dentists' opinion on dental therapists performing irreversible procedures and dental therapists alleviating the disparity in access to dental care. A stratified random sample of 1,000 dentists were invited to participate in an online survey. One hundred eighteen dentists responded (11.8%). The results indicated most dentists opposed dental therapists performing extractions of permanent teeth; however, results were mixed on dentists' opinions for dental therapists performing restorations of primary and permanent teeth and cavity preparation. Further, results also indicated that the majority of dentist respondents did not believe dental therapists will alleviate the disparity in access to dental care.

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CHAPTER ONE

Introduction

Studies on the impact of dental therapists in the United States are limited.

In 2003, the Alaska Native Tribal Health Consortium established the dental health aide therapist program, and in 2009 Minnesota law authorized licensure of dental therapists and advanced dental therapists. The state of Maine passed legislation in 2014 permitting licensure of this mid-level dental care provider (1). Vermont passed legislation in 2016 allowing for licensure of dental therapists (2).

A study by Bailit et al (2012) reported that in New Zealand, Canada, Australia, the United Kingdom, and several other countries, dental therapists provided diagnostic, preventive, and restorative procedures. By providing these services, dental therapists in these countries extended the services provided by dentists, especially in underserved areas (3).

A study by Blue, Rockwood, and Riggs (2015) indicated that despite services provided by dental therapists, most dentists in Minnesota did not believe this mid-level dental care provider would alleviate the disparity of access to dental care for low-income populations. The study also indicated that Minnesota dentists did not think dental therapists should perform irreversible procedures (4). However, a study by Aksu, Phillips, and Shaefer (2013) stated in other countries where dental therapists had been practicing for many years, the opinion of dentists changed from one of skepticism to acceptance (5). If Minnesota dentists' attitudes have changed to a more receptive perspective, then it is possible that other states in the United States with workforce models for the dental

therapist will be more likely to pass legislation allowing licensure of these healthcare providers.

Statement of Problem

The purpose of this study was to quantify Minnesota dentists' attitudes regarding the utilization of dental therapists in that state. Dental therapists have been licensed to practice in Minnesota since 2009. Has the opinion of practicing dentists changed? Do most practicing dentists in the state still oppose the utilization of dental therapists for irreversible procedures? Do most dentists still believe dental therapists will not alleviate the disparity of access to dental care for low-income populations?

Significance of the Problem

A study by the United States Department of Health and Human Services (2015) indicates that from 2012 to 2025, the supply of dentists will not meet the demand for dentists; however, the supply of dental hygienists will exceed demand (6). Friedman, J.W. and Mathu-Muju, K.R. (2014) state that most of the 43 million children covered by Medicaid and the Children's Health Insurance programs have limited access to dental care (7). The study also indicates that dental care disparities are most prevalent among low-income populations.

According to the report *Healthy People 2020*, lack of access to dental care is still an issue in the United States (8). One strategy to improve access is to increase the number of public health centers that include dental services. Access to dental care for these populations can significantly improve in the United States if more states pass legislation

allowing licensure of dental therapists, who can provide services at community health clinics.

Despite early opposition from the ADA, the concept of the dental therapist has been endorsed by other groups such as the American Public Health Association and the American Association of Public Health Dentistry (9, 10). The main concern of the ADA was the ability of dental therapists to provide safe and competent care. In 2015, The ADA Commission on Dental Education (CODA) implemented accreditation standards for dental therapy education programs (12).

This issue was addressed in a study by Phillips and Shaefer (2013), where they reviewed nearly two dozen studies from countries with dental therapists. Each study that directly compared the work of dental therapists to that of dentists concluded that dental therapists performed as well as dentists when providing the same irreversible procedures (11).

Another concern of private practitioners is that dental therapists in the workforce may diminish their income (7). However, workforce models proposed for dental therapists are not intended to compete with dentists, as most dental therapists work or will work in public health (7).

Another setting for dental therapists is the Accountable Care Organization (ACO) where dental services are integrated with primary healthcare services. Blue and Riggs (2016) stated that as more health insurance companies recognize the connection between various chronic diseases and oral health, ACOs could effectively improve health

outcomes while lowering the cost of healthcare (13). This paradigm shift could be accelerated by the inclusion of dental therapists into the primary healthcare team.

An early impact study conducted by the Minnesota Department of Health and the Minnesota Board of Dentistry (2014) was one of the first to evaluate the impact of dental therapists and advanced dental therapists in Minnesota (14). As of February 2014, there were 32 dental therapists licensed in Minnesota, six of whom completed the necessary requirements to be licensed as an advanced dental therapist. This study indicated initial public health impacts were positive, as the clinics that employed dental therapists were seeing more patients. There were no quality or safety concerns, and patients experienced reduced wait times and travel distances. More research is necessary, as these were early outcomes.

The field of medicine has come to accept mid-level providers such as nurse practitioners and physician assistants despite initial resistance to such changes. In other countries where dental therapists have been practicing for many years, the initial opposition by dentists has been replaced by acceptance. The purpose of this study was to quantify Minnesota dentists' attitudes regarding the utilization of dental therapists in that state. If the initial opinion of Minnesota dentists has become more accepting, then perhaps this will motivate the ADA to change their opinion, which, in turn, will lead to more states passing legislation allowing for licensure of dental therapists.

Operational Definitions

Expanded-function dental hygienist: Dental hygienists may qualify for a restorative certificate by completing a state dental board approved continuing education course and

obtaining a restorative certification. The restorative services provided by dental hygienists may include the following services (15):

- Apply cavity liner/base
- Place (and carve and finish) amalgam restoration
- Place and finish composite restoration
- Place and/or remove temporary restoration
- Place and/or remove temporary crown
- Fabricate temporary crown

Dental Therapist: In Minnesota, dental therapists provide educational, clinical and therapeutic services. Dental therapists in Minnesota also dispense medications and may supervise up to four dental assistants (14). Depending upon the service provided the dental therapist practices either under indirect supervision or general supervision of a dentist.

Prior to performing any services, a dental therapist must enter into a written collaborative agreement with a dentist who is licensed in Minnesota. The agreement must include the following (14):

1. practice settings where services may be provided and the populations to be served;
2. any limitations on the services that may be provided by the dental therapist, including the level of supervision required by the collaborating dentist;
3. age- and procedure-specific practice protocols, including case selection criteria, assessment guidelines, and imaging frequency;
4. a procedure for creating and maintaining dental records for the patients that are treated by the dental therapist;
5. a plan to manage medical emergencies in each practice setting where the dental therapist provides care;
6. a quality assurance plan for monitoring care provided by the dental therapist;
7. protocols for administering and dispensing medications authorized under subdivision 5, and section 150A.106, including the specific conditions and circumstance under which these medications are to be dispensed and administered;

8. criteria relating to the provision of care to patients with specific medical conditions or complex medication histories, including requirements for consultation prior to the initiation of care;
9. supervision criteria of dental assistants; and
10. a plan for the provision of clinical resources and referrals in situations which are beyond the capabilities of the dental therapist (Appendix B, p. 28).

Advanced Dental Therapist: In Minnesota, the advanced dental therapist provides the same services as therapist, but under general supervision. Advanced dental therapists must also have a collaborative management agreement with a dentist. The advanced dental therapist must complete 2,000 hours of supervised clinical practice and pass a certification exam for advanced practice which includes the additional duties of oral assessment and evaluation, treatment plan formulation, and nonsurgical extractions of diseased teeth (14).

Mid-level Dental Care Providers: The American Dental Hygiene Association defines the mid-level oral health practitioner as follows (1):

A licensed dental hygienist who has graduated from an accredited dental hygiene program and who provides primary oral healthcare directly to patients to promote and restore oral health through assessment, diagnosis, treatment, evaluation, and referral services. The Mid-level Oral Health Practitioner has met the educational requirements to provide services within an expanded scope of care under regulations set forth by the appropriate licensing agency.

CHAPTER TWO

Literature Review

Introduction

The purpose of this literature review is to review various research studies conducted on dental therapists. The term for this mid-level dental care provider varies depending upon the country and/or state where this professional is licensed.

PubMed/MeSH and Google search engines were used to access journal articles. The key terms used in the search include the following: dental therapists, advanced dental therapists, mid-level dental care providers, and access to dental care.

This literature review covers such areas as the global history of dental therapists outside of the United States, the history of dental therapists in the United States to include dental health aide therapists in Alaska and dental therapists and advanced dental therapists in Minnesota, the quality of technical competence of dental therapists, and the acceptance of dental therapists by dentists and the public.

It should be noted that Nash et al (2014) published the most current and comprehensive literature review on dental therapists. The W.K. Kellogg Foundation provided funding for this study (16). Nash and 17 consultants from 17 countries contributed to this research endeavor where 1,100 documents relating to dental therapists in the global dental workforce were identified and published in the bibliography of the Kellogg report.

Global History of Dental Therapists

The concept of the dental therapist began in New Zealand in 1921 with the establishment of the School of Dental Service (16, 17). Upon graduation from a two-year post high school vocational training program, the initial 29 “dental nurses” worked in public schools where they provided dental care for children. Other countries followed New Zealand’s lead, and to date, current research indicates 54 countries utilize dental therapists with most of them working under the supervision of a dentist in public health where they provide treatment for children (7, 16). The dental therapy workforce model is more common in countries that were members of the British Commonwealth (16).

The scope of practice of the dental therapist varies from country to country and state to state and includes expanded duties such as cavity preparation, simple extractions, pulpotomies, pain management, prescription writing for select medications, case management, and collaboration with other health professionals (16).

Dental Therapists in the United States

Several studies indicate that access to dental care in the United States is limited for low-income adults and children (6, 7, 8). Other barriers to health care and oral health care include personal and structural barriers, which include the lack of healthcare professionals available to provide services to these individuals (8). The advent of the dental therapist in the United States aims to bridge this gap.

The Indian Health Service began this endeavor in the United States in 2003 when the Alaska Native Tribal Health Consortium (ANTHC) sent six individuals to New Zealand for the two-year post high school dental health aide therapy training in order to

address the prevalence of dental disease and lack of dentists in Alaska tribal villages (16, 17). These individuals were trained as dental health aide therapists (DHATs) to provide services to Alaskan tribal villages on federal property. Dental health aide therapists work under the supervision of dentists who establish the scope of practice of DHATs by documenting the services that they can perform (17). DHATs are not licensed to practice in the state of Alaska (18).

A study by Rodriguez et al (2013) provides a comparison of mid-level dental providers (18). Minnesota dental therapists and advanced dental therapists possess a master's degree, whereas the dental health therapy aides attend two academic years post high school. There are CODA standards for dental therapy programs; however, there are no CODA standards for DHAT programs (12, 18).

In February of 2017, the state of Washington became the first of the lower forty-eight states to allow dental health aide therapists to service American Native Tribe members. They must do so in Indian Health Service practice settings located within the boundaries of a tribal reservation (19). It should be noted that the state of Washington does not have a DHAT license; however, DHATs are exempt if they are certified by a federal community health aide program (19).

Earlier attempts were made in the United States to add dental therapists to the workforce. In 1949, Massachusetts passed legislation allowing dental hygienists in public health to prepare and fill cavities under the supervision of a dentist after two years of training (20). One year later this law was rescinded in response to pressure from dental associations. Another program that was developed in Massachusetts to train dental

hygienists to provide basic dental services in the 1970s was terminated due to pressure from dentists (21).

In 2009, the state of Minnesota passed legislation allowing for the licensure of dental therapists and advanced dental therapists to treat low-income, uninsured and underserved individuals (1, 4, 14, 16). Two Minnesota academic institutions offer a dental therapy program leading to a master's degree (4). The University of Minnesota offers a Master of Dental Therapy degree leading to certification as a dental therapist. Metropolitan State University awards a master's degree to dental hygienists who have earned a baccalaureate degree, and this dental therapist may also practice dental hygiene (to include scaling and root planning) with a dual license. Graduates from both programs must complete 2000 hours of dental therapy clinical practice under the supervision of a dentist and must pass a board-approved certification exam in order to practice as an advanced dental therapist (4, 14).

An early impact study of dental therapists conducted by the Minnesota Board of Dentistry in collaboration with the Minnesota Department of Health (2014) in Minnesota lists the services dental therapists may provide under **general** supervision. Under general supervision, a dentist may authorize performance of the following services but is not necessarily on site (14):

- Oral Health instruction and disease prevention, including nutritional counseling and dietary analysis;
- Preliminary charting of the oral cavity;
- Making radiographs;
- Mechanical polishing;
- Application of topical preventive or prophylactic agents, including fluoride varnishes and pit and fissure sealants;
- Pulp vitality testing;

- Application of desensitizing medication or resin;
- Fabrication of athletic mouthguards;
- Placement of temporary restorations;
- Fabrication of soft occlusal guards;
- Tissue conditioning and soft reline;
- Atraumatic restorative therapy;
- Dressing changes;
- Tooth reimplantation;
- Administration of local anesthetic; and
- Administration of nitrous oxide (Appendix C, p. 29).

Per the same study (Appendix C, pp. 29-30), dental therapists may perform the following services under **indirect** supervision. Under indirect supervision, a dentist is on-site and provides authorization for procedures:

- Emergency palliative treatment of dental pain;
- Placement and removal of space maintainers;
- Cavity preparation;
- Restoration of primary and permanent teeth;
- Placement of temporary crowns;
- Preparation and placement of preformed crowns;
- Pulpotomies on primary teeth;
- Indirect and direct pulp capping on primary and permanent teeth;
- Stabilization of re-implanted teeth;
- Extractions of primary teeth;
- Suture Removal;
- Brush biopsies;
- Repair of defective prosthetic devices; and
- Recementing of permanent crowns

Advanced dental therapist services can be provided under **general** supervision and include (p. 5):

- All services a dental therapist provides;
- Oral evaluation and assessment;
- Treatment plan formulation;
- Routine, nonsurgical extractions of certain diseased teeth.

Per Minnesota law, dental therapists may supervise up to four dental assistants in any one practice setting. Dental therapists may also dispense the following drugs: analgesics, anti-inflammatories, and antibiotics (14).

This early impact study of dental therapists in Minnesota states that 6,338 new patients were seen by dental therapists during the first two years when dental therapists began working in the study clinics (14). Survey results of patients indicated a reduction in wait time for services and decreased travel time for treatment. Clinics utilizing dental therapists reported increased productivity and an expanded capacity to provide services to more patients. This study was limited, as there were only five dental therapists practicing during the time of the study, but these early findings indicate that the dental therapy workforce was increasing and fulfilling statutory intent (14).

Blue and Kaylor (2016) conducted a limited, descriptive research study on dental therapy practice standards in Minnesota (22). Four practices comprised the study: two rural practices and two federally qualified health clinics. One federally qualified health clinic was a mobile-based model located in a small urban location, and the other clinic was located in a large urban location. The study stated the majority of services provided by dental therapists at all four locations were restorative. As a result, dentists at all four locations performed fewer restorative and preventive services, and at two practices, the dentists took on more complex procedures as the result of the presence of a dental therapist. The study also reported that dental therapists at all four locations were utilized to their full scope of practice, which indicates acceptance by the dentists (22).

A study published by Blue, Rockwood, and Riggs (2015) examined the attitudes and perceptions of Minnesota dentists toward the dental therapist (4). This was the first cross-sectional study conducted on the Minnesota dental therapy workforce model. The researchers sampled 1,000 licensed dentists in Minnesota and assigned the dentists to one of three strata: metropolitan (500 dentists), larger out-state cities (250 dentists), and rural areas (250 dentists). Sampling weights were applied to all analysis given the disproportional sampling method. Fifty-five percent of the sampled dentists responded (4).

The results indicated the majority of dentists were in favor of dental therapists performing reversible procedures; however, the majority of dentists were opposed to dental therapists performing irreversible procedures. Dentists working in group practices and non-profit clinics had a more favorable opinion of dental therapists and were more likely to hire dental therapists (4).

The main barrier for hiring dental therapists was patient acceptance. Sixty-five percent of the dentists surveyed indicated that having a dental therapist on staff would disrupt the dentist's relationship with patients. When asked if dental therapists would be part of the solution to the increasing need for dental care in Minnesota, 59% of the dentists responded that dental therapists would have no effect on access to care (4).

In August 2015, the Commission on Dental Accreditation adopted accreditation standards for dental therapy education programs (12). The ADA responded that while they support CODA in ensuring high quality standards for dental education, they still oppose non-dentists performing surgical procedures such as the extraction of teeth (24). A

press release issued by the ADA in February of 2017 stated that there is a critical need to connect underserved people seeking dental care with dentists (27).

Technical Competence of Dental Therapists Compared to Dentists

Several studies have been conducted that evaluate the quality of technical care provided by dental therapists. One of the main concerns of dentists and professional dental associations in the United States is the belief that dental therapists provide a lower quality of care, which threatens public safety (16). Existing studies on this matter indicate the quality of technical care provided by dental therapists over the past 60 years was comparable to that of dentists (16).

A summary review of global observational studies, randomized clinical trials, and empirical studies found that dental therapists safely and competently performed irreversible procedures within their scope of practice (11). A study out of Great Britain indicated that dental therapists performed screenings for dental caries and periodontal disease as well as dentists (28).

In an assessment of treatment provided by dental health aide therapists in Alaska (2008), Bolin examined the records of 640 dental procedures performed by dental health aide therapists. His research concluded there were no significant differences between irreversible dental restorations completed by dental therapists and dentists (29).

Acceptance of Dental Therapists

A cross-sectional questionnaire by Blue et al (2013) indicates that there was a higher acceptance rate of the new dental therapist model by dentists who had prior working experience with expanded-function dental hygienists (30). In other countries

where dental therapists have been practicing for many years, the attitude of dentists has moved from one of skepticism to one of acceptance (5).

Despite the initial opposition of the American Dental Association, the dental therapy workforce model is accepted by other professional associations in the United States. Professional associations that accept the dental therapy model include, but are not limited to, the American Public Health Association, the American Association of Public Health Dentistry, and the American Dental Hygienists' Association. These groups recognize that the concept of a mid-level dental provider allows greater access to oral healthcare for underserved populations (7, 16).

A study conducted by Lakeside Research Partners for the W.K. Kellogg Foundation surveyed 1,023 adults in the United States (31). The majority of those surveyed indicated that it is difficult to get low-cost dental care in their communities. The main reasons for putting off dental care were costs and lack of dental insurance. Seventy-six percent of those surveyed supported the dental therapy workforce model (31).

There is great public support in other countries where dental therapists provide treatment for school children, and Nash found no evidence in any of the 1,100 studies on dental therapists indicating the public perspective was less than positive (16). Nash's global literature review cited a previous study also conducted by Nash (2004) that noted the people of New Zealand believed dental therapists and the School Dental Services were "integral components" of New Zealand culture (32). In this study, Nash stated, "To Kiwis it is like motherhood, apple pie and the flag" (p. 12).

Summary

Current and past research on dental therapists indicates that within their scope of practice, dental therapists perform as well as dentists and are accepted by the public. In the United States, the American Dental Association and various state dental associations greatly oppose the utilization of dental therapists for irreversible procedures; however, dentists who work with dental therapists and those dentists who hold academic positions are more accepting of the dental therapy workforce model. Initial studies on dental therapists in Minnesota indicated they were being utilized to their full scope of practice, and therefore, were alleviating the disparity of access to dental care for low-income populations.

CHAPTER THREE

Methods and Materials

The purpose of this research was to evaluate the attitudes of Minnesota dentists toward the dental therapy workforce model. Past studies indicate that most Minnesota dentists did not believe dental therapists will increase access to dental care in the state, and most did not believe dental therapists should perform irreversible procedures. A survey was constructed for this study to assess the opinions of Minnesota dentists toward the dental therapy workforce model.

Research Design

The survey queried the demographics of participants to include years of practice and the type of dental setting where the participants practice dentistry. The questionnaire queried Minnesota dentists' opinion toward the dental therapy workforce model.

The survey included ten questions: eight questions that queried their attitude toward the dental therapy workforce model and two demographic questions.

The survey included the following questions regarding dentists' attitudes toward dental therapists/advanced dental therapists performing the following three irreversible procedures (strongly oppose, somewhat oppose, neither favor or oppose, somewhat favor, strongly favor):

- Restoration of primary and permanent teeth
- Extractions of primary teeth
- Cavity preparation

The survey also included the following three questions regarding dentists' attitudes dental therapists/advanced dental therapists performing the following reversible

procedures toward (strongly oppose, somewhat oppose, neither favor or oppose, somewhat favor, strongly favor):

- Placement and removal of space maintainers
- Placement of temporary restorations
- Placement of temporary crowns

The survey asked the dentists' opinion to the following (strongly agree, somewhat agree, somewhat disagree, strongly disagree):

- The employment of a dental therapist/advanced dental therapist allows a dentist to devote more time to complex procedures.
- Dental therapists/advanced dental therapists help to alleviate the disparity in access to dental care in Minnesota.

The survey included the following three demographic questions:

- Number of years in practice (1-10 years, 11-20 years, over twenty years)
- Type of practice (solo, group, government, academic)

A survey methods expert was consulted regarding the construction of the survey and analysis of the survey results. This study was approved with exempt status from the University of New Mexico Institutional Review Board (IRB).

Sample

The sample for this study consisted of 1,000 dentists who were actively licensed to practice dentistry in the State of Minnesota.

Data Collection

Participants were placed into one of three strata (metropolitan, micropolitan, and rural) based on the 2010 Rural-Urban Commuting Area Codes provided by the Rural Health Research Center at the University of Washington (<http://depts.washington.edu/uwruca/>) (33). An introductory post card was mailed to

1,000 randomly selected actively licensed Minnesota dentists inviting them to participate in an online survey at surveymonkey.com. Five hundred postcards were mailed to dentists in the metropolitan strata, and 250 postcards were mailed to dentists in both the micropolitan and rural strata. In order to properly track responses based on zip code classification, the postcards had one of three links to the survey depending upon the zip code classification of the participant.

Data Analysis

Descriptive statistics and chi-square tests were used to analyze the survey responses. Chi-square tests were used to determine if differences existed in the responses for each question on reversible and irreversible procedures, more time for complex procedures, and access to dental care ($\alpha = .05$). Chi-square tests were also used to determine if statistically significant differences existed in the survey responses toward access of care based on location of practice ($\alpha = .05$).

Chi-square tests were used to analyze survey responses on irreversible procedures for this research and the study conducted by Blue et al.

CHAPTER FOUR

Results, Discussion and Conclusion

Summary of Results

The survey opened on October 3, 2017 when postcards were mailed to the dentists in each of the three strata. A reminder postcard was mailed on November 8, 2017, and the survey closed on December 8, 2017.

A total of 118/1,000 or dentists completed the survey for a response rate of almost twelve percent (11.8%). Most of the respondents had been in practice for twenty years or more (54/116). Most of the dentists who participated in this survey worked in a group practice (57/117) (Figures 1 and 2).

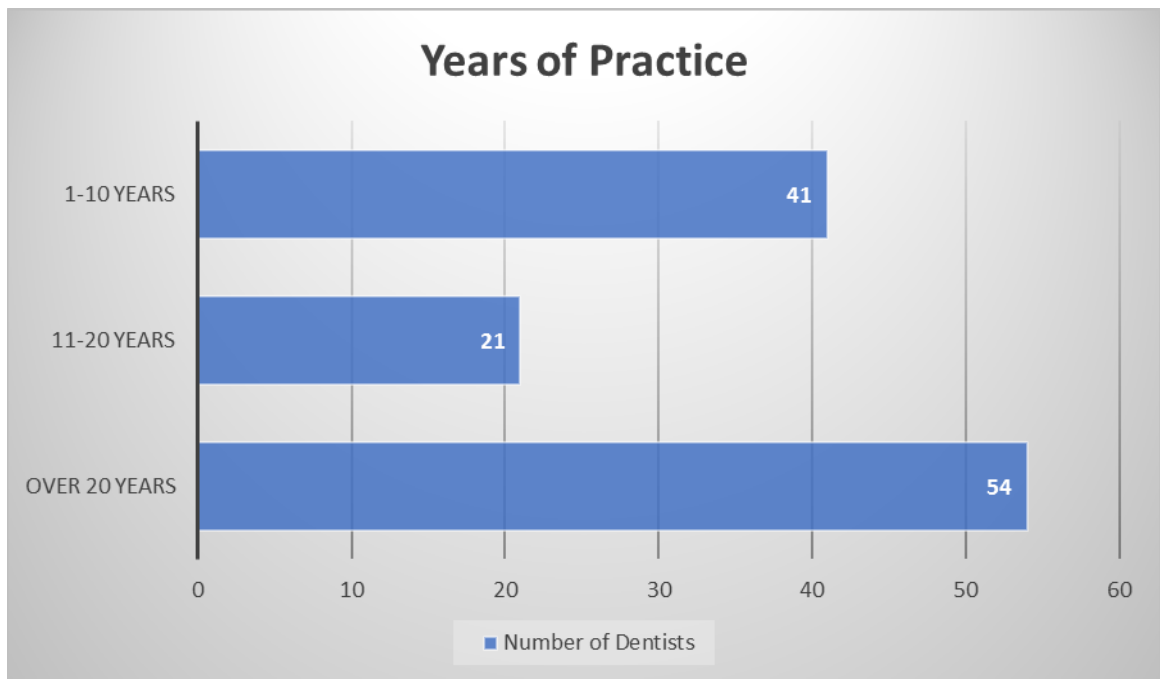


Figure 1. Frequency for Years of Practice

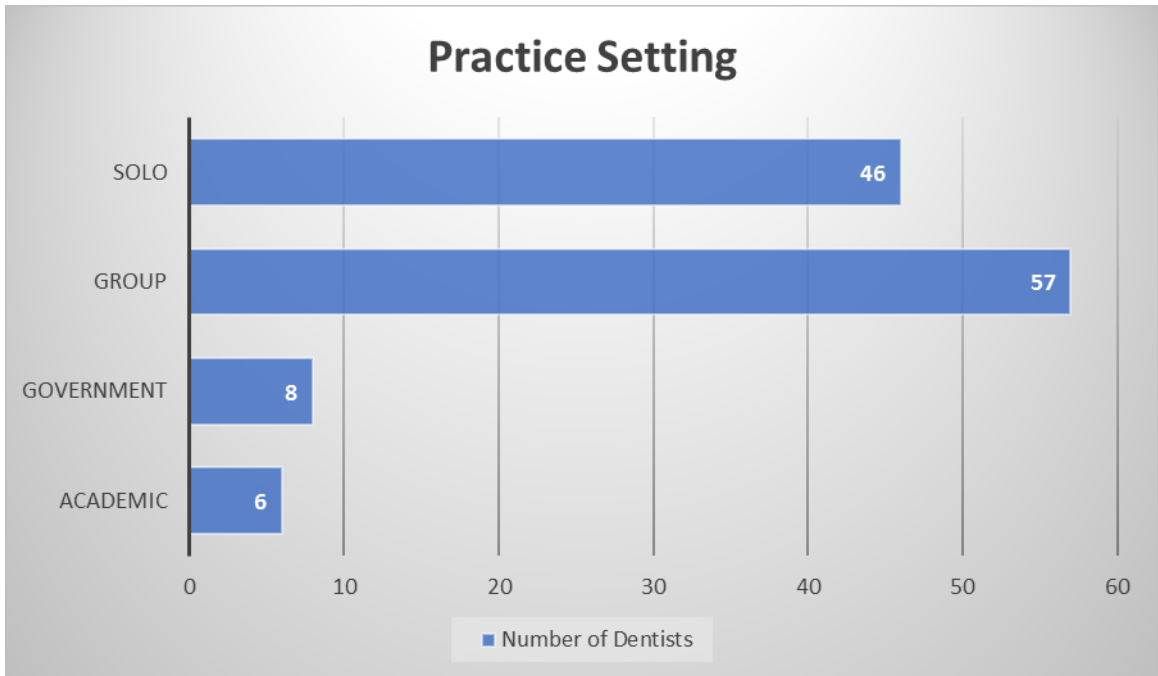


Figure 2. Frequency for Practice Setting

For the query on dental therapists performing irreversible and reversible procedures, the descriptive data indicated that most dentists opposed dental therapists performing irreversible procedures. (Table 1).

Table 1. Opinion on Dental Therapists Performing Irreversible and Reversible Procedures

PROCEDURE	STRONGLY OPPOSE	SOMEWHAT OPPOSE	SOMEWHAT FAVOR	STRONGLY FAVOR	TOTAL RESPONSES
Restoration of primary and permanent teeth	n = 34 (33.33%)	n = 21 (20.59%)	n = 23 (22.55%)	n = 24 (23.53%)	n = 102 (100%)
Extractions of primary teeth	n = 37 (35.92%)	n = 29 (28.16%)	n = 16 (15.53%)	n = 21 (20.39%)	n = 103 (100%)
Cavity preparation	n = 42 (38.18%)	n = 23 (20.91%)	n = 25 (22.73%)	n = 20 (18.18%)	n = 110 (100%)
Placement of temporary restorations	n = 9 (9.1%)	n = 14 (14.14%)	n = 34 (34.34%)	n = 42 (42.42%)	n = 99 (100%)
Placement and removal of space maintainers	n = 17 (17.71%)	n = 17 (17.7%)	n = 31 (32.29%)	n = 31 (32.29%)	n = 96 (100%)
Placement of temporary crowns	n = 14 (14.58%)	n = 15 (15.63%)	n = 28 (29.17%)	n = 39 (40.62%)	n = 96 (100%)

Descriptive data for the query on more time for complex procedures indicated slightly more dentists strongly disagreed (35/117) or somewhat disagreed (15/117) that employing a dental therapist or advanced dental therapist would allow them to devote more time to complex procedures (Figure 3).

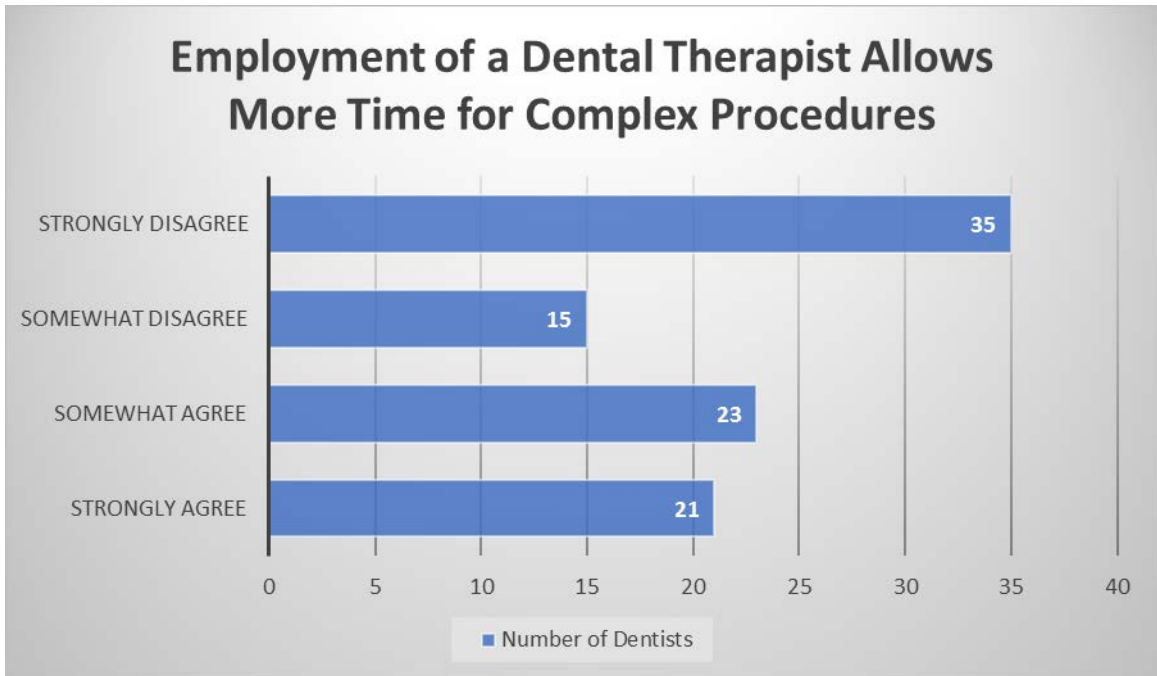


Figure 3. Employment of Dental Therapists and Time for Complex Procedures

Descriptive data for the query on dental therapists helping to alleviate access to dental care indicated most dentists strongly disagreed or somewhat disagreed (73/116) that dental therapists help to alleviate the disparity in access to dental care (Figure 4).

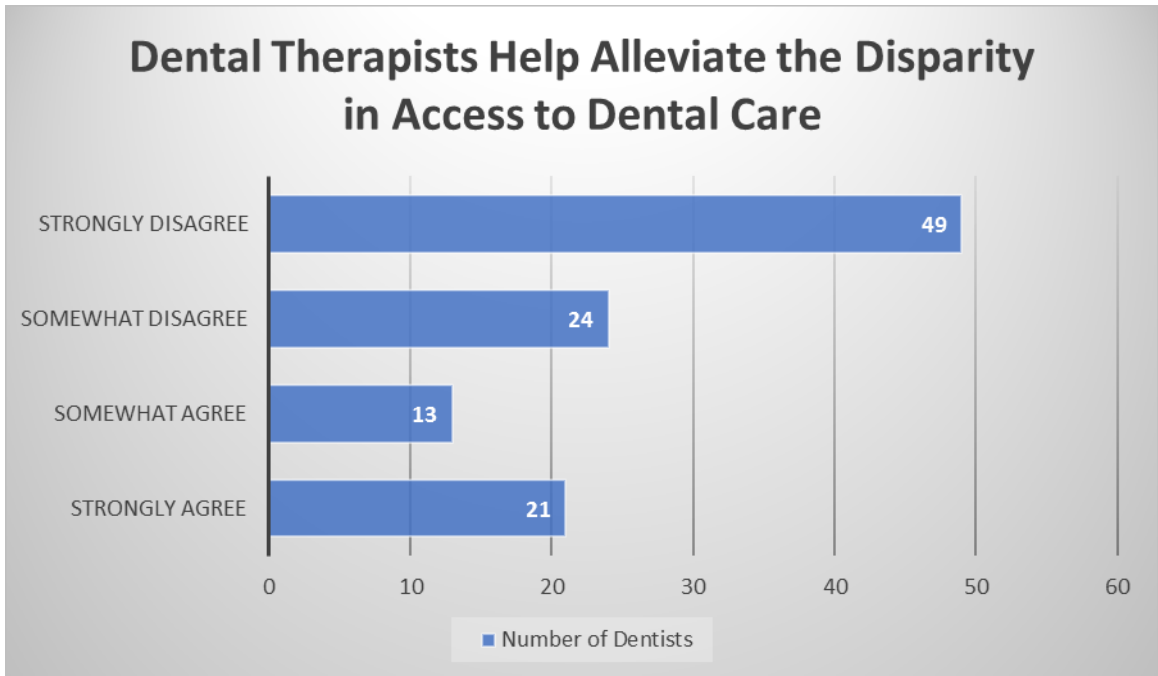


Figure 4. Dentists’ Opinion on Dental Therapists Alleviating Access to Dental Care

Descriptive statistics indicated that more dentists from location one (metropolitan) did not believe that dental therapists would help to alleviate the disparity in access to dental care (Figure 5).

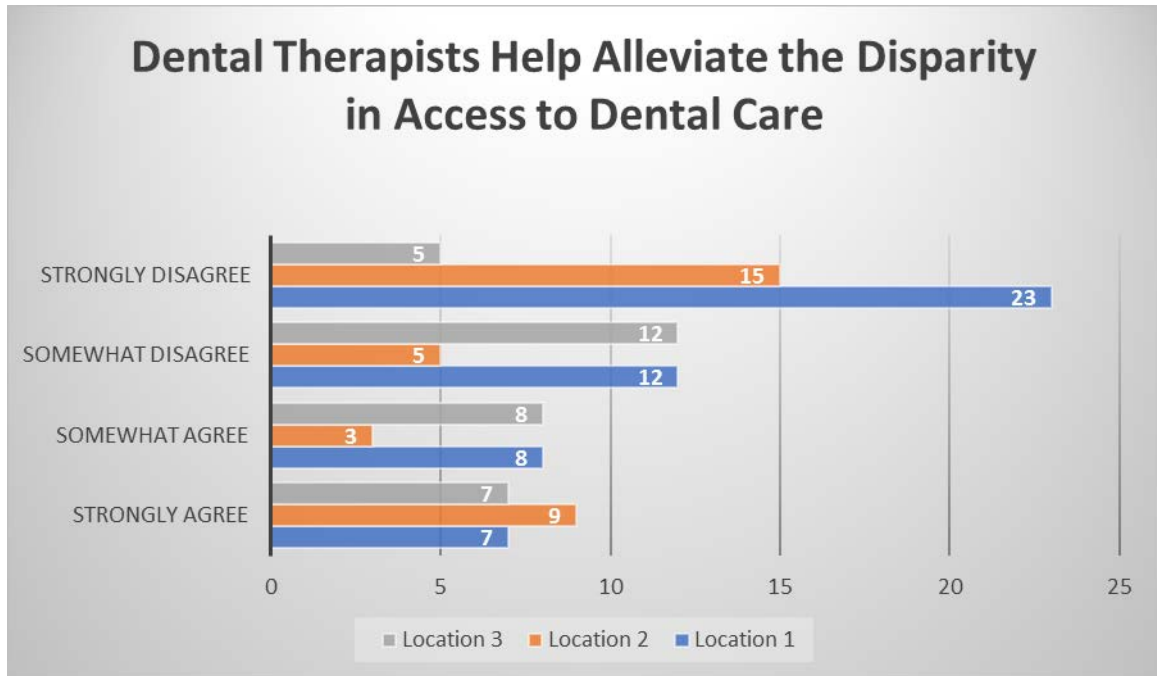


Figure 5. Opinion on Access to Care Based on Location of Practice

Chi-square tests on each irreversible procedure ($\alpha=.05$, $df=1$) indicated $p=.428$ for the restoration of primary and permanent teeth and $p=.056$ for cavity preparation (Table 2). The null hypothesis was not rejected for responses on these two procedures. Statistical evidence indicated no difference of opinion for these procedures. The chi-square test results for extractions of primary teeth indicated $p=.0025$ ($\alpha=.05$, $df=1$), so the null hypothesis was rejected. Statistical evidence indicated most dentists opposed dental therapists performing this procedure (Table 2).

Chi-square tests for each reversible procedure ($\alpha=.05$, $df=1$) indicated most dentists were in favor of dental therapists performing these procedures, as the p value for each procedure was less than .05 (Table 2).

Table 2. Chi Square Test Results for Responses to Irreversible and Reversible

Procedures

Procedure	Observed Response Range	Expected Response Range	Chi Square	P value
Restoration of primary and permanent teeth	n = 55-47	51	.6275	.428
Extractions of primary teeth	n = 68-37	52.5	9.152	.0025
Cavity preparation	n = 64-45	55	3.636	.056
Placement of temporary restorations	n = 13-77	45	44.596	.000
Placement and removal of space maintainers	n = 34-62	48	8.167	.0043
Placement of temporary crowns	n = 29-67	48	15.042	.0001

The chi-square test on the responses to the query on more time for complex procedures indicated $p=.536$ ($\alpha=.05$, $df=1$), so the null hypothesis was not rejected.

Statistical evidence indicates no difference of opinion for the responses to this question (Table 3).

Table 3. Chi Square Test Results for Responses to Time for Complex Procedures

Actual Response Range	Expected Response Range	Chi Square	P value
50-44	47	.383	.536

Chi-square test results for the query on dental therapists alleviating the disparity in access to dental care indicated $p=.001$ ($\alpha=.05$, $df=1$), so the null hypothesis was rejected (Table 4). Results of the chi-square test indicated that most dentists did not believe that

dental therapists and advanced dental therapists would affect the disparity in access to care.

Table 4. Chi-Square Test results for Access to Dental Care

Actual Response Range	Expected Response Range	Chi-Square	P value
33-73	53	15.094	.0001

Table 5 presents cross table of location of practice and perceived help of dental therapists to alleviate disparity in access to dental care. Results indicated 70% of respondents in location one disagreed that dental therapists would alleviate disparity in access to dental care. Results indicated 62.5% of respondents in location two disagreed that dentists would alleviate disparity in access to dental care while the corresponding percentage in location three was 75%.

Table 6 presents the cross table of location and expected frequencies. Results of the chi-square test indicated that the null hypothesis of no significant association between perceived help and location of practice cannot be rejected at .05 level of significance ($\chi^2(2) = 1.056, p = .589$). Therefore, it is concluded that there was no statistical evidence to infer dentists' opinions on access to dental care varied by location.

Table 5. Cross table of location and response to perceived help to alleviate disparity in access to dental care

Location	Disagree	Agree	Total
Location 1 Metropolitan	n = 35 (70)	n = 15 (30)	n = 50 (100)
Location 2 Micropolitan	n = 20 (62.50)	n = 12 (37.50)	n = 32 (100)
Location 3 Rural	n = 8 (75.0)	n = 6 (25.0)	n = 24 (100)
Total	n = 73 (68.87)	n = 33 (31.13)	n = 106 (100)

Note: Value in parenthesis are percentage to the row total

Table 6. Cross table of location and expected frequency (expected row percentages) of response to perceived help to alleviate disparity in access to dental care

Location	Disagree	Agree	Total
Location 1 Metropolitan	34.4 (68.8)	15.6 (31.2)	50 (100)
Location 2 Micropolitan	22.04 (68.88)	9.96 (31.12)	32 (100)
Location 3 Rural	16.5 (68.75)	7.5 (31.25)	24 (100)
Total	73 (68.87)	33 (31.13)	106 (100)

Note: Value in parenthesis are percentage to the row total

Limitations

This study was limited by the low response rate (11.8%). A higher response rate would have provided results that more accurately reflect the opinion of all practicing dentists in Minnesota.

Discussion

Since studies on the dental therapy workforce model in the United States are limited, results from this study were compared to the study by Blue et al. Descriptive statistics of the study conducted by Blue, Rockwood and Riggs and published in 2015 indicated the majority of dentists opposed dental therapists performing irreversible procedures (4). Results from this current study differ from those of Blue et al in that no difference of opinion was indicated for the restoration of primary and permanent teeth and cavity preparation. Results of both studies indicated the majority of dentists favor dental therapists performing placement of temporary restorations, placement and removal of space maintainers, and placement of temporary crowns.

Descriptive data comparing the two studies indicated that a higher percentage of dentists in the study by Blue et al strongly opposed dental therapists performing restoration of primary and permanent teeth, extractions of primary teeth, and cavity preparation (Figure 6).

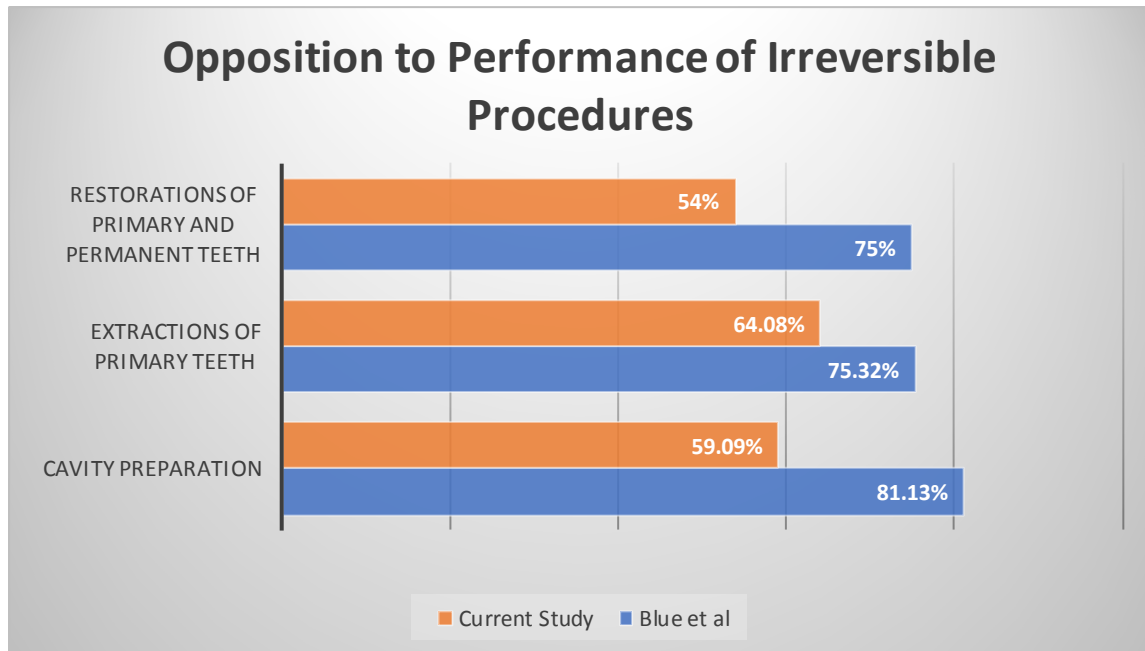


Figure 6. Comparison of Irreversible Procedure Responses

Table 7 presents cross table of study and response to dental therapists performing restorations on primary and permanent teeth. When comparing these studies 75% of respondents in the study by Blue et al opposed dental therapists performing this procedure. In the current study 54% of respondents in the current study opposed dental therapists performing restorations on primary and permanent teeth.

Table 8 presents the cross table of study and expected frequencies. Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 17.731, p = .0000$). Therefore, it is concluded that there was statistical evidence to infer that fewer dentists in the current study opposed dental therapists performing restorations on primary and permanent teeth.

Table 7. Cross table of responses to dental therapists performing restorations of primary and permanent teeth

Study	Disagree	Agree	Total
Blue et al	n = 413 (75)	n = 138 (25)	n = 551 (100)
Current Study	n = 55 (54)	n = 47 (46)	n = 102 (100)
Total	n = 468 (71.67)	n = 185 (28.33)	n = 653 (100)

Note: Value in parenthesis are percentage to the row total

Table 8. Cross table of expected frequencies of response to dental therapists performing restorations of primary and permanent teeth

Study	Disagree	Agree	Total
Blue et al	395 (78.40)	156 (21.60)	551 (100)
Current study	73.1 (71.67)	28.9 (28.33)	102 (100)
Total	512 (78.41)	141 (21.59)	653 (100)

Note: Value in parenthesis are percentage to the row total

Table 9 presents cross table of study and response to dental therapists performing extractions of primary teeth. When comparing these studies 75.32% of respondents in the study by Blue et al opposed dental therapists performing this procedure. In the current study 64.08% of respondents opposed dental therapists performing extractions of primary teeth.

Table 10 presents the cross table of study and expected frequencies. Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 5.0722$,

p = .0243). Therefore, it is concluded that there was statistical evidence to infer that fewer dentists in the current study opposed dental therapists extracting primary teeth.

Table 9. Cross table of responses to dental therapists performing extractions of primary teeth

Study	Disagree	Agree	Total
Blue et al	n = 415 (75.32)	n = 136 (24.68)	n = 551 (100)
Current study	n = 66 (64.08)	n = 37 (35.92)	n = 103 (100)
Total	n = 481 (71.67)	n = 173 (28.33)	n = 654 (100)

Note: Value in parenthesis are percentage to the row total

Table 10. Cross table of expected frequencies to dental therapists performing extractions of primary teeth

Study	Disagree	Agree	Total
Blue et al	405 (78.40)	146 (21.60)	551 (100)
Current study	75.8 (71.67)	27.2 (28.33)	103 (100)
Total	480.8 (73.52)	173.2 (26.48)	654 (100)

Note: Value in parenthesis are percentage to the row total

Table 11 presents cross table of study and response to dental therapists performing cavity preparation. When comparing these studies 81.13% of respondents in the study by Blue et al opposed dental therapists performing this procedure. In the current study 59.09% of respondents in the current study opposed dental therapists performing cavity preparation.

Table 12 presents the cross table of study and expected frequencies. Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 24.251$, $p = .0000$). Therefore, it is concluded that there is statistical evidence to infer that fewer dentists in the current study oppose dental therapists performing cavity preparation.

Table 11. Cross table of responses to dental therapists performing cavity preparation

Study	Disagree	Agree	Total
Blue et al	n = 447 (81.13)	n = 104 (18.87)	n = 551 (100)
Current study	n = 65 (59.09)	n = 45 (40.91)	n = 110 (100)
Total	n = 512 (77.46)	n = 149 (22.54)	n = 661 (100)

Note: Value in parenthesis are percentage to the row total

Table 12. Cross table expected frequencies to dental therapists performing cavity preparation

Study	Disagree	Agree	Total
Blue et al	427 (78.40)	124 (21.60)	551 (100)
Current study	85.2 (77.45)	24.8 (22.55)	110 (100)
Total	512.2 (77.49)	148.8 (22.51)	661 (100)

Note: Value in parenthesis are percentage to the row total

Descriptive statistics in the study by Blue, et al indicated that about one third of the dentists indicated that employing a dental therapist would allow more time for complex procedures (4). This study indicated nearly 38% of respondents believed the

same, whereas a previous study by Blue and Kaylor indicated dentists took on more complex procedures as the result of the employment of a dental therapist (17).

As far as access to dental care, the study by Blue et al and this study indicated most dentists did not believe dental therapists would alleviate the disparity in access to dental care. Further research is needed to determine if differences exist between the two studies.

Conclusion

Results of this study indicated that most dentists opposed dental therapists and advanced dental therapists performing extractions of primary teeth; however, no difference of opinion existed for dental therapists and advanced dental therapists performing cavity preparation and the restoration of primary and permanent teeth. This study also indicated that most dentist respondents did not oppose dental therapists and advanced dental therapists performing placement of temporary restorations, placement and removal of space maintainers, and placement of temporary crowns (reversible procedures). Results of this study were mixed in response to the question on dental therapists allowing dentists more time for complex procedures.

Results of this study indicated most dentists did not believe dental therapists would alleviate the disparity in access to dental care. There was no difference of opinion based on location of practice.

Results from this study indicated fewer Minnesota dentists opposed dental therapists performing restorations of primary and permanent teeth, extractions of primary

teeth, and cavity preparation than those queried in a previous study. This indicates a possible trend toward acceptance of the dental therapy workforce model.

Due to the limited research on the dental therapy workforce model in the United States, this study significantly impacts the body of knowledge on this topic. Further research is necessary to assess the opinion of Minnesota dentists on the dental therapy workforce model.

CHAPTER FIVE

Article for Submission

Title Page

Minnesota Dentists' Opinion of the Dental Therapy Workforce Model

Marguerite J. Rogers, RDH, MS

University of New Mexico

mjrogers@salude.unm.edu

(843) 263-5868

Key words: dental therapist, advanced dental therapist, dental therapy workforce model

Abstract

Objectives: The purpose of this study was two-fold. One purpose was to quantify Minnesota dentists' opinions on dental therapists performing irreversible and irreversible procedures. The second purpose was to determine if Minnesota dentists believed dental therapists will help to alleviate access to dental care.

Methods: An introductory post card was mailed to 1,000 randomly selected actively licensed Minnesota dentists inviting them to participate in an online survey. The survey included ten questions: Eight questions that queried their attitude toward the dental therapy workforce model and two demographic questions. Descriptive statistics were used for all questions. Chi-square tests were used to determine statistical significance.

Results: A total of 118 dentists responded. Chi-square tests produced p-values at less than alpha at .05 for placement of temporary restorations, placement and removal of space maintainers, and placement of temporary crowns and for extractions of primary teeth. Chi-square tests also produced p levels at less than alpha at .05 for the query on access to dental care.

Conclusion: Significant differences were identified for opinions on reversible procedures (placement of temporary restorations, placement and removal of space maintainers, and placement of temporary crowns) and one irreversible procedure (extractions of primary teeth). Significant differences were identified for responses on access to dental care. Most

Minnesota dentists are in favor of dental therapists performing reversible procedures, and most oppose dental therapists performing cavity preparation. Most Minnesota dentists do not believe dental therapists will alleviate access to dental care.

Introduction

Description of the Problem

Studies on the impact of dental therapists in the United States are limited. In 2003, the Alaska Native Tribal Health Consortium established the dental health aide therapist program, and in 2009 Minnesota law authorized licensure of dental therapists and advanced dental therapists. Dental therapists in Minnesota possess a master's degree, whereas DHATs have two years of training post high school (18). The state of Maine passed legislation in 2014 permitting licensure of this mid-level dental care provider (1). Vermont passed legislation in 2016 allowing for licensure of dental therapists (2). Both Maine and Vermont used the dental therapy workforce model established by the state of Minnesota.

A study by Bailit et al (2012) reported that in New Zealand, Canada, Australia, the United Kingdom, and several other countries, dental therapists provided diagnostic, preventive, and restorative procedures. By providing these services, dental therapists in these countries extended the services provided by dentists, especially in underserved areas (3). Vocational training for two to three years is the educational standard in most countries, and a certificate or diploma is awarded upon completion of the program. However, some countries have moved dental therapy education programs to university settings (16).

A study by Blue, Rockwood, and Riggs (2015) indicated that despite services provided by dental therapists, most dentists in Minnesota did not believe this mid-level dental care provider would alleviate the disparity of access to dental care for low-income populations. The study also indicated that Minnesota dentists did not think dental therapists should perform irreversible procedures (4). However, a study by Aksu, Phillips, and Shaefer (2013) stated in other countries where dental therapists have been practicing for many years, the opinion of dentists changed from one of skepticism to acceptance (5). If Minnesota dentists' attitudes have changed to a more receptive perspective, then it is possible that other states in the United States with workforce models for the dental therapist will pass legislation allowing licensure of these healthcare providers.

The purpose of this study was to quantify Minnesota dentists' attitudes regarding the utilization of dental therapists in that state. Dental therapists have been licensed to practice in Minnesota for six years. Has the opinion of practicing dentists changed? Do most practicing dentists in the state still oppose the utilization of dental therapists for irreversible procedures? Do most dentists still believe dental therapists will not alleviate the disparity of access to dental care for low-income populations?

Literature Review

Nash et al (2014) published the most current and comprehensive literature review on dental therapists. The W.K. Kellogg Foundation provided funding for this study (16). Nash and 17 consultants from 17 countries contributed to this research endeavor where 1,100 documents relating to dental therapists in the global dental workforce were identified and published in the bibliography of the Kellogg report.

The concept of the dental therapist began in New Zealand in 1921 with the establishment of the School of Dental Service (16, 17). Upon graduation from a two-year post high school vocational training program, the initial 29 “dental nurses” worked in public schools where they provided dental care for children. Other countries followed New Zealand’s lead, and to date, current research indicates 54 countries utilize dental therapists with most of them working under the supervision of a dentist in public health where they provide treatment for children (7, 16). The education level of dental therapists varies from two to three-year vocational programs to master’s degree programs (18).

The scope of practice of the dental therapist varies from country to country and state to state and includes expanded duties such as cavity preparation, simple extractions, pulpotomies, pain management, prescription writing for select medications, case management, and collaboration with other health professionals (16).

Several studies indicate that access to dental care in the United States is limited for low-income adults and children (6, 7, 8). Other barriers to health care and oral health care include personal and structural barriers, which include the lack of healthcare professionals available to provide services to these individuals (8). The advent of the dental therapist in the United States aims to bridge this gap.

The Indian Health Service began this endeavor in the United States in 2003 when the Alaska Native Tribal Health Consortium (ANTHC) sent six individuals to New Zealand for the two-year post high school dental health aide therapy training in order to address the prevalence of dental disease and lack of dentists in Alaska tribal villages (16, 17). These individuals were trained as dental health aide therapists (DHATs) to provide

services to Alaskan tribal villages on federal property. DHATs are not licensed through the state (18).

In February of 2017, the state of Washington became the first of the lower forty-eight states to allow dental health aide therapists to service American Native Tribe members. They must do so in Indian Health Service practice settings located within the boundaries of a tribal reservation, just as the dental health aide therapists in Alaska (19). It should be noted that the state of Washington does not have a DHAT license; however, DHATs are exempt if they are certified by a federal community health aide program (19).

In 2009, the state of Minnesota passed legislation allowing for the licensure of dental therapists and advanced dental therapists to treat low-income, uninsured and underserved individuals (1, 4, 14, 16). Two Minnesota academic institutions offer a dental therapy program leading to a master's degree (4). The University of Minnesota offers a Master of Dental Therapy degree leading to certification as a dental therapist. Metropolitan State University awards a master's degree to dental hygienists who have earned a baccalaureate degree, and this dental therapist may also practice dental hygiene (to include scaling and root planning) with a dual license. Graduates from both programs must complete 2000 hours of dental therapy clinical practice under the supervision of a dentist and must pass a board-approved certification exam in order to practice as an advanced dental therapist (4, 14).

An early impact study of dental therapists conducted by the Minnesota Board of Dentistry in collaboration with the Minnesota Department of Health (2014) in Minnesota lists the services dental therapists may provide under **general** supervision. Under general

supervision, a dentist may authorize performance of the following services but is not necessarily on site (14):

- Oral Health instruction and disease prevention, including nutritional counseling and dietary analysis;
- Preliminary charting of the oral cavity;
- Making radiographs;
- Mechanical polishing;
- Application of topical preventive or prophylactic agents, including fluoride varnishes and pit and fissure sealants;
- Pulp vitality testing;
- Application of desensitizing medication or resin;
- Fabrication of athletic mouthguards;
- Placement of temporary restorations;
- Fabrication of soft occlusal guards;
- Tissue conditioning and soft relines;
- Atraumatic restorative therapy;
- Dressing changes;
- Tooth reimplantation;
- Administration of local anesthetic; and
- Administration of nitrous oxide (Appendix C, p. 29).

Per the same study (Appendix C, pp. 29-30), dental therapists may perform the following services under **indirect** supervision. Under indirect supervision, a dentist is on-site and provides authorization for procedures:

- Emergency palliative treatment of dental pain;
- Placement and removal of space maintainers;
- Cavity preparation;
- Restoration of primary and permanent teeth;
- Placement of temporary crowns;
- Preparation and placement of preformed crowns;
- Pulpotomies on primary teeth;
- Indirect and direct pulp capping on primary and permanent teeth;
- Stabilization of re-implanted teeth;
- Extractions of primary teeth;
- Suture Removal;
- Brush biopsies;
- Repair of defective prosthetic devices; and
- Recementing of permanent crowns

Advanced dental therapist services can be provided under **general** supervision and include (p. 5):

- All services a dental therapist provides;
- Oral evaluation and assessment;
- Treatment plan formulation;
- Routine, nonsurgical extractions of certain diseased teeth.

Per Minnesota law, dental therapists may supervise up to four dental assistants in any one practice setting. Dental therapists may also dispense the following drugs: analgesics, anti-inflammatories, and antibiotics (14).

This early impact study of dental therapists in Minnesota stated that 6,338 new patients were seen by dental therapists during the first two years dental therapists began working in the study clinics (14). Survey results of patients indicated a reduction in wait time for services and decreased travel time for treatment. Clinics utilizing dental therapists reported increased productivity and an expanded capacity to provide services to more patients. This study was limited, as there were only five dental therapists practicing during the time of the study, but these early findings indicated that the dental therapy workforce is increasing and fulfilling statutory intent (14).

A study published by Blue, Rockwood, and Riggs (2015) examined the attitudes and perceptions of Minnesota dentists toward the dental therapist (4). This was the first cross-sectional study conducted on the Minnesota dental therapy workforce model. The researchers sampled 1,000 licensed dentists in Minnesota and assigned the dentists to one of three strata: metropolitan (500 dentists), larger out-state cities (250 dentists), and rural areas (250 dentists). Sampling weights were applied to all analysis given the

disproportional sampling method. Fifty-five percent of the sampled dentists responded (4).

The results indicated the majority of dentists were in favor of dental therapists performing reversible procedures; however, the majority of dentists were opposed to dental therapists performing irreversible procedures. Dentists working in group practices and non-profit clinics had a more favorable opinion of dental therapists and were more likely to hire dental therapists (4).

Several studies have been conducted evaluating the quality of technical care provided by dental therapists. One of the main concerns of dentists and professional dental associations in the United States is the belief that dental therapists provide a lower quality of care, which threatens public safety (16). Existing studies on this matter indicate the quality of technical care provided by dental therapists over the past 60 years is comparable to that of dentists (16).

A summary review of global observational studies, randomized clinical trials, and empirical studies found that dental therapists safely and competently performed irreversible procedures within their scope of practice (11).

The dental therapy workforce model is accepted by other professional associations in the United States. Professional associations that accept the dental therapy model include, but are not limited to, the American Public Health Association, the American Association of Public Health Dentistry, and the American Dental Hygienists' Association. These groups recognize that the concept of a mid-level dental provider allows greater access to oral healthcare for underserved populations (9, 10, 16).

In August 2015, the Commission on Dental Accreditation adopted accreditation standards for dental therapy education programs (12). The ADA responded that while they support CODA in ensuring high quality standards for dental education, they still oppose non-dentists performing surgical procedures such as the extraction of teeth (24). A press release issued by the ADA in February of 2017 stated that there is a critical need to connect underserved people seeking dental care with dentists (27).

Methods and Materials

A survey was constructed for this study to quantify the opinions of Minnesota dentists toward the dental therapy workforce model. The survey queried the demographics of participants to include years of practice and the type of dental setting where the participants practice dentistry. The survey also queried Minnesota dentists' opinion toward the dental therapy workforce model.

The survey included ten questions: Eight questions that queried their attitude toward the dental therapy workforce model and two demographic questions.

The survey included the following questions regarding dentists' attitudes toward (strongly oppose, somewhat oppose, neither favor or oppose, somewhat favor, strongly favor) dental therapists/advanced dental therapists performing the following three irreversible procedures:

- Restoration of primary and permanent teeth
- Extractions of primary teeth
- Cavity preparation

The survey also included the following three questions regarding dentists' attitudes toward (strongly oppose, somewhat oppose, neither favor or oppose, somewhat

favor, strongly favor) dental therapists/advanced dental therapists performing the following reversible procedures:

- Placement and removal of space maintainers
- Placement of temporary restorations
- Placement of temporary crowns

The survey asked the dentists' opinion (strongly agree, somewhat agree, somewhat disagree, strongly disagree) to the following:

- The employment of a dental therapist/advanced dental therapist allows a dentist to devote more time to complex procedures.
- Dental therapists/advanced dental therapists help to alleviate the disparity in access to dental care in Minnesota.

The survey included the following three demographic questions:

- Number of years in practice (1-10 years, 11-20 years, over twenty years)
- Type of practice (solo, group, government, academic)

The sample for this study consisted of 1,000 dentists who were actively licensed to practice dentistry in the State of Minnesota. Participants were placed into one of three strata (metropolitan, micropolitan, and rural) based on the 2010 Rural-Urban Commuting Area Codes provided by the Rural Health Research Center at the University of Washington (<http://depts.washington.edu/uwruca/>) (33).

An introductory post card was mailed to 1,000 randomly selected actively licensed Minnesota dentists inviting them to participate in an online survey at surveymonkey.com. Five hundred postcards were mailed to dentists in the metropolitan strata, and 250 postcards were mailed to dentists in both the micropolitan and rural strata. In order to properly track responses based on zip code classification, the postcards had one of three links to the survey depending upon the zip code classification of the participant.

Descriptive statistics and chi-square tests were used to analyze both the demographic data and the queries of dentists' opinions.

Chi-square tests were used to determine if differences existed in the responses for each question on reversible and irreversible procedures, more time for complex procedures and access to dental care ($\alpha = .05$). Chi-square tests were also used to determine if statistically significant differences existed in the survey responses toward access of care based on location of practice ($\alpha = .05$). Chi-square tests were also used to compare the results of this study with a study conducted by Blue et al (4).

Results

A total of 118/1,000 or dentists completed the survey for a response rate of almost twelve percent (11.8%). Most of the respondents had been in practice for twenty years or more (54/116). Most of the dentists who participated in this survey worked in a group practice (57/117) (Figures 1 and 2).

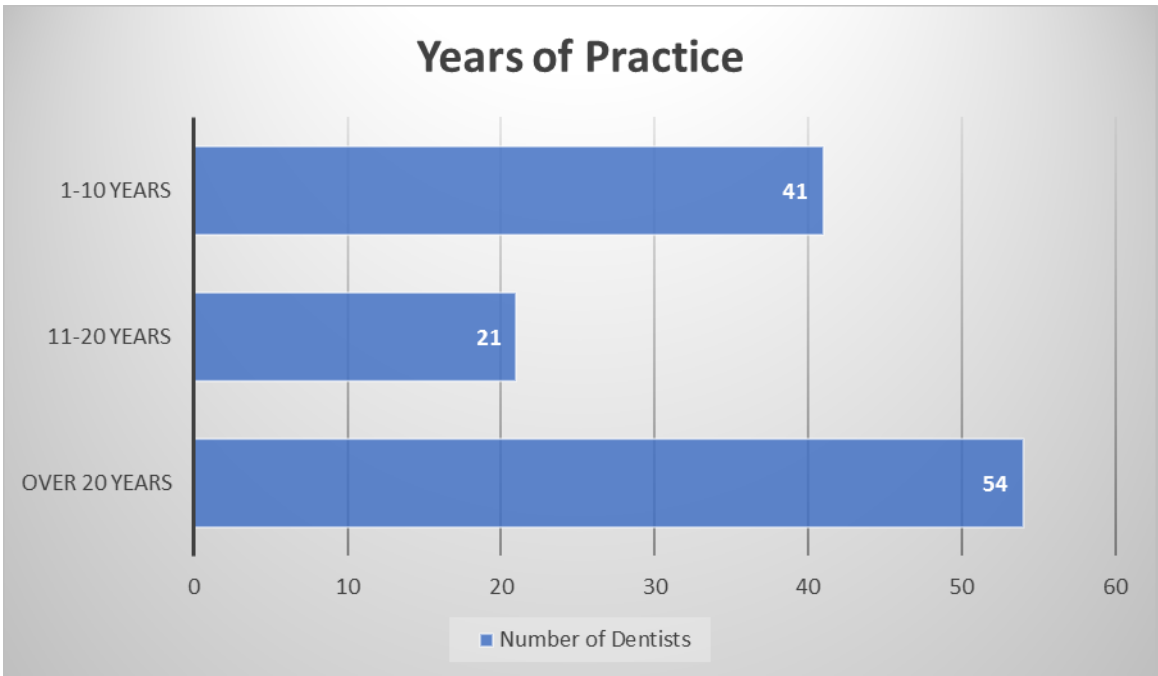


Figure 1. Frequency for Years of Practice

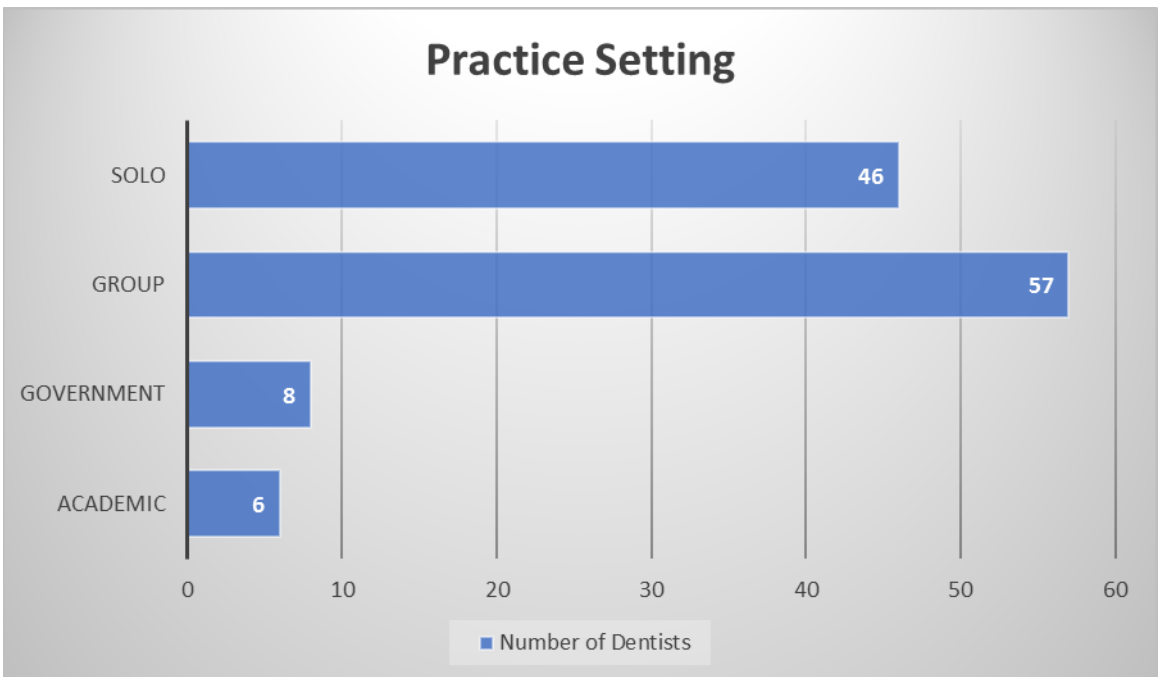


Figure 2. Frequency for Practice Setting

For the query on dental therapists performing irreversible and reversible procedures, the descriptive data indicated that most dentists opposed dental therapists performing irreversible procedures. (Table 1).

Table 1. Opinion on Dental Therapists Performing Irreversible and Reversible Procedures

PROCEDURE	STRONGLY OPPOSE	SOMEWHAT OPPOSE	SOMEWHAT FAVOR	STRONGLY FAVOR	TOTAL RESPONSES
Restoration of primary and permanent teeth	n = 34 (33.33%)	n = 21 (20.59%)	n = 23 (22.55%)	n = 24 (23.53%)	n = 102 (100%)
Extractions of primary teeth	n = 37 (35.92%)	n = 29 (28.16%)	n = 16 (15.53%)	n = 21 (20.39%)	n = 103 (100%)
Cavity preparation	n = 42 (38.18%)	n = 23 (20.91%)	n = 25 (22.73%)	n = 20 (18.18%)	n = 110 (100%)
Placement of temporary restorations	n = 9 (9.1%)	n = 14 (14.14%)	n = 34 (34.34%)	n = 42 (42.42%)	n = 99 (100%)
Placement and removal of space maintainers	n = 17 (17.71%)	n = 17 (17.7%)	n = 31 (32.29%)	n = 31 (32.29%)	n = 96 (100%)
Placement of temporary crowns	n = 14 (14.58%)	n = 15 (15.63%)	n = 28 (29.17%)	n = 39 (40.62%)	n = 96 (100%)

Descriptive data for the query on more time for complex procedures indicated slightly more dentists strongly disagreed (35/117) or somewhat disagreed (15/117) that

employing a dental therapist or advanced dental therapist would allow them to devote more time to complex procedures (Figure 3).

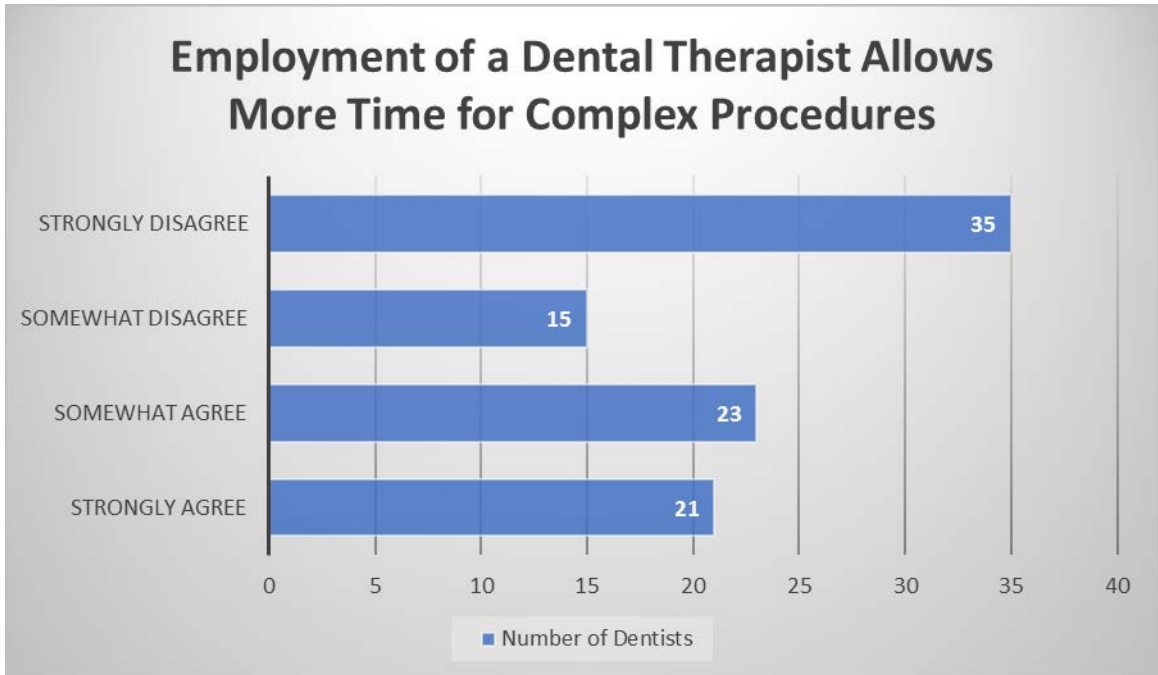


Figure 3. Employment of Dental Therapists and Time for Complex Procedures

Descriptive data for the query on dental therapists helping to alleviate access to dental care indicated most dentists strongly disagreed or somewhat disagreed (73/116) that dental therapists help to alleviate the disparity in access to dental care (Figure 4).

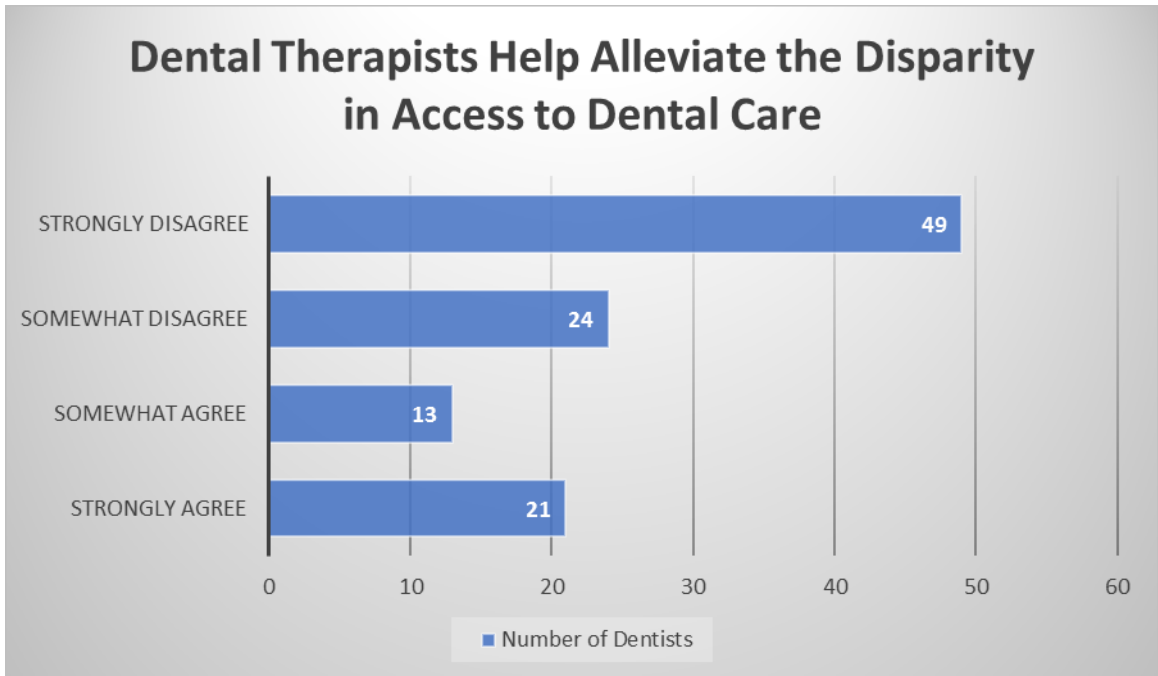


Figure 4. Dentists’ Opinion on Dental Therapists Alleviating Access to Dental Care

Descriptive statistics indicated that more dentists from location one (metropolitan) did not believe that dental therapists would help to alleviate the disparity in access to dental care (Figure 5).

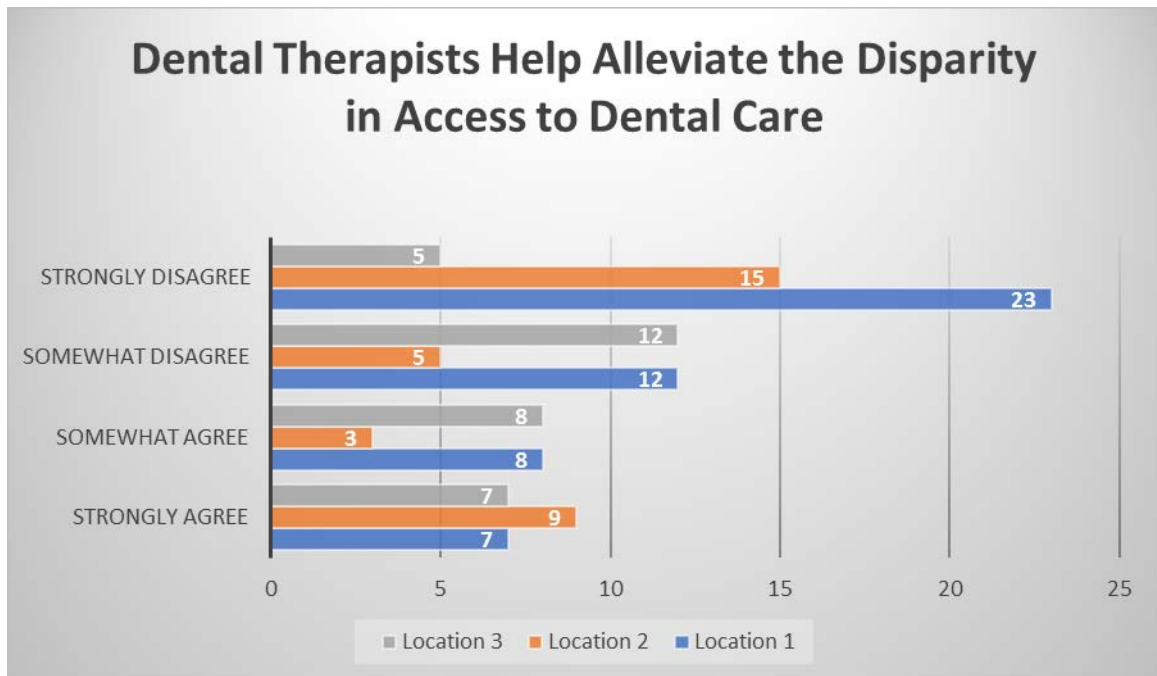


Figure 5. Opinion on Access to Care Based on Location of Practice

Chi-square tests on each irreversible procedure ($\alpha=.05$, $df=1$) indicated $p=.428$ for the restoration of primary and permanent teeth and $p=.056$ for cavity preparation (Table 2). The null hypothesis was not rejected for responses on these two procedures. Statistical evidence indicated no difference of opinion for these procedures. The chi-square test results for extractions of primary teeth indicated $p=.0025$ ($\alpha=.05$, $df=1$), so the null hypothesis was rejected. Statistical evidence indicated most dentists opposed dental therapists performing this procedure (Table 2).

Chi-square tests for each reversible procedure ($\alpha=.05$, $df=1$) indicated most dentists were in favor of dental therapists performing these procedures, as the p value for each procedure was less than .05 (Table 2).

Table 2. Chi Square Test Results for Responses to Irreversible and Reversible Procedures

Procedure	Observed Response Range	Expected Response Range	Chi Square	P value
Restoration of primary and permanent teeth	n = 55-47	51	.6275	.428
Extractions of primary teeth	n = 68-37	52.5	9.152	.0025
Cavity preparation	n = 64-45	55	3.636	.056
Placement of temporary restorations	n = 13-77	45	44.596	.000
Placement and removal of space maintainers	n = 34-62	48	8.167	.0043
Placement of temporary crowns	n = 29-67	48	15.042	.0001

The chi-square test on the responses to the query on more time for complex procedures indicated $p=.536$ ($\alpha=.05$, $df=1$), so the null hypothesis was not rejected. Statistical evidence indicates no difference of opinion for the responses to this question (Table 3).

Table 3. Chi Square Test Results for Responses to Time for Complex Procedures

Actual Response Range	Expected Response Range	Chi Square	P value
50-44	47	.383	.536

Chi-square test results for the query on dental therapists alleviating the disparity in access to dental care indicated $p=.001$ ($\alpha=.05$), so the null hypothesis was rejected (Table

4). Results of the chi-square test indicated that most dentists did not believe that dental therapists and advanced dental therapists would affect the disparity in access to care.

Table 4. Chi-Square Test results for Access to Dental Care

Actual Response Range	Expected Response Range	P value
33-73	53	.0001

Table 5 presents cross table of location of practice and perceived help of dental therapists to alleviate disparity in access to dental care. Results indicated 70% of respondents in location one disagreed that dental therapists would alleviate disparity in access to dental care. Results indicated 62.5% of respondents in location two disagreed that dentists would alleviate disparity in access to dental care while the corresponding percentage in location three was 75%.

Table 6 presents the cross table of location and expected frequencies. Results of the chi-square test indicated that the null hypothesis of no significant association between perceived help and location of practice cannot be rejected at .05 level of significance ($\chi^2(2) = 1.056, p = .589$). Therefore, it is concluded that there was no statistical evidence to infer dentists' opinions on access to dental care varied by location.

Table 5. Cross table of location and response to perceived help to alleviate disparity in access to dental care

Location	Disagree	Agree	Total
Location 1 Metropolitan	n = 35 (70)	n = 15 (30)	n = 50 (100)
Location 2 Micropolitan	n = 20 (62.50)	n = 12 (37.50)	n = 32 (100)
Location 3 Rural	n = 8 (75.0)	n = 6 (25.0)	n = 24 (100)
Total	n = 73 (68.87)	n = 33 (31.13)	n = 106 (100)

Note: Value in parenthesis are percentage to the row total

Table 6. Cross table of location and expected frequency (expected row percentages) of response to perceived help to alleviate disparity in access to dental care

Location	Disagree	Agree	Total
Location 1 Metropolitan	34.4 (68.8)	15.6 (31.2)	50 (100)
Location 2 Micropolitan	22.04 (68.88)	9.96 (31.12)	32 (100)
Location 3 Rural	16.5 (68.75)	7.5 (31.25)	24 (100)
Total	73 (68.87)	33 (31.13)	106 (100)

Note: Value in parenthesis are percentage to the row total

Limitations

This study was limited by the low response rate (11.8%). A higher response rate would have provided results that more accurately reflect the opinion of all practicing dentists in Minnesota.

Discussion

Descriptive statistics of the study conducted by Blue, Rockwood and Riggs and published in 2015 indicated the majority of dentists opposed dental therapists performing irreversible procedures (4). Results from this current study differ from those of Blue et al in that no difference of opinion was indicated for the restoration of primary and permanent teeth and cavity preparation. Results of both studies indicated the majority of dentists favor dental therapists performing reversible procedures.

Descriptive data comparing the two studies indicated that a higher percentage of dentists in the study by Blue et al strongly oppose dental therapists performing irreversible procedures (Figure 6).

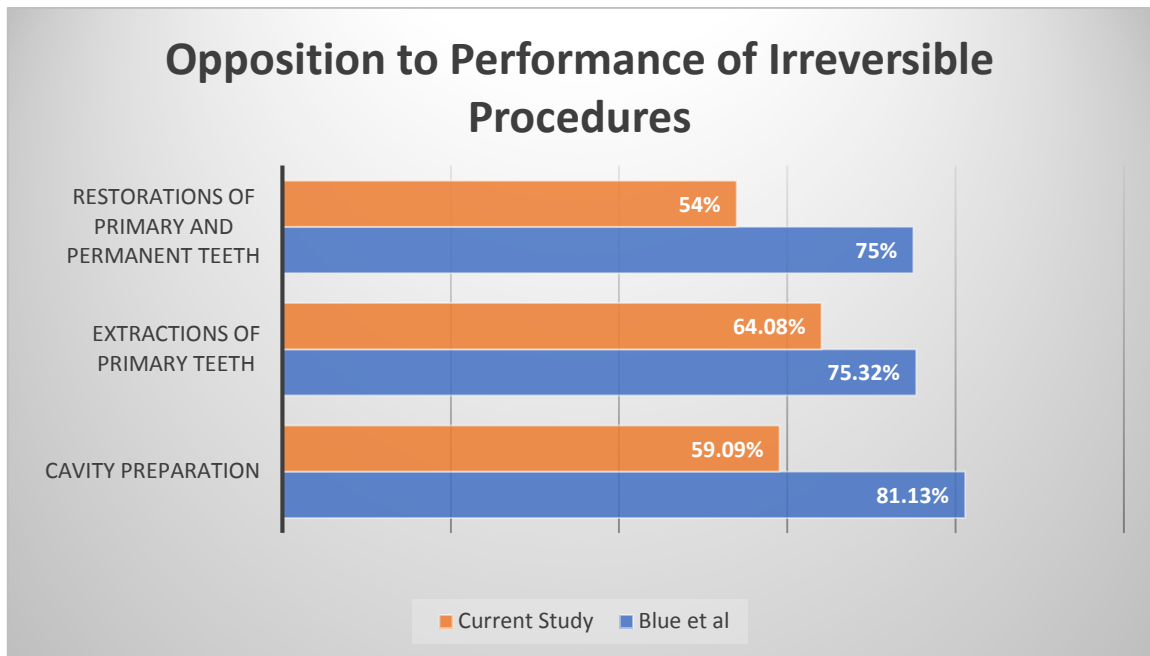


Figure 6. Comparison of Irreversible Procedure Responses

When comparing these studies 75% of respondents in the study by Blue et al opposed dental therapists performing this procedure. In the current study 54% of

respondents in the current study opposed dental therapists performing restorations on primary and permanent teeth.

Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 17.731, p = .0000$). Therefore, it was concluded that there is statistical evidence to infer that fewer dentists in the current study opposed dental therapists performing restorations on primary and permanent teeth.

When comparing these studies 75.32% of respondents in the study by Blue et al opposed dental therapists performing extractions of primary teeth. In the current study 64.08% of respondents in the current study opposed dental therapists performing extractions of primary teeth.

Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 5.0722, p = .0243$). Therefore, it was concluded that there is statistical evidence to infer that fewer dentists in the current study opposed dental therapists extracting primary teeth.

When comparing these studies 81.13% of respondents in the study by Blue et al opposed dental therapists performing cavity preparation. In the current study 59.09% of respondents in the current study strongly opposed dental therapists performing cavity preparation.

Results of the chi-square test indicated that the null hypothesis of no significant association between the study responses can be rejected at .05 level of significance ($\chi^2 (2) = 24.251, p = .0000$). Therefore, it was concluded that there is statistical evidence to infer

that fewer dentists in the current study opposed dental therapists performing cavity preparation.

Conclusion

Results of this study indicated that most dentists opposed dental therapists and advanced dental therapists performing extractions of primary teeth; however, no difference of opinion existed for dental therapists and advanced dental therapists performing cavity preparation and the restoration of primary and permanent teeth. This study also indicated most dentists do not oppose dental therapists and advanced dental therapists performing placement of temporary restorations, placement and removal of space maintainers, and placement of temporary restorations. (reversible procedures).

Results of this study are mixed in response to the question on dental therapists allowing dentists more time for complex procedures.

Results of this study indicated most dentists do not believe dental therapists will alleviate the disparity in access to dental care. There is no difference of opinion based on location of practice.

Results from this study indicated fewer Minnesota dentists oppose dental therapists performing restorations of primary and permanent teeth, extractions of primary teeth and cavity preparation than those queried in a previous study by Blue et al (4). This indicates a possible trend toward acceptance of the dental therapy workforce model.

Due to the limited research on the dental therapy workforce model in the United States, this study significantly impacts the body of knowledge on this topic. Further

research is necessary to assess the opinion of Minnesota dentists on the dental therapy workforce model.

APPENDICES

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Appendix A:
HRRC Approval Letter



*Human Research Review Committee
Human Research Protections Office*

September 20, 2017

Christine Nathe
University of New Mexico
MSC09 5020
Albuquerque, NM 87131
(505) 272-8147
Fax: (505) 272-5584
CNathe@salud.unm.edu

Dear Christine Nathe:

On 9/20/2017, the HRRC reviewed the following submission:

Type of Review: Initial Study
Title of Study: Minnesota Dentists' Opinion of the Dental Therapy Workforce Model
Investigator: Christine Nathe
Study ID: 17-337
Submission ID: 17-337
IND, IDE, or HDE: None

Submission Summary: Initial Study
Documents Approved:

- Survey on the Minnesota Dental Therapy Workforce Model.pdf
- survey monkey consent.pdf
- unm irb.pdf
- mn dentist postard.pdf

Review Category: EXEMPTION: Categories (2) Tests, surveys, interviews, or observation.

Determinations/Waivers: Provisions for consent are adequate.
HIPAA is not applicable.

Submission Approval Date: 9/20/2017
Approval End Date: None
Effective Date: **9/20/2017**

The HRRC approved the study from 9/20/2017 to inclusive. If modifications were required to secure approval, the effective date will be later than the approval date. The "Effective Date" 9/20/2017 is the date the HRRC approved your modifications and, in all cases, represents the date study activities may begin.

Because it has been granted exemption, this research is not subject to continuing review.

Please use the consent documents that were approved and stamped by the HRRC. The stamped and approved consents are available for your retrieval in the "Documents" tab of the parent study.

This determination applies only to the activities described in this submission and does not apply should you make any changes to these documents. If changes are being considered and there are questions about whether HRRC review is needed, please submit a study modification to the HRRC for a determination. A change in the research may disqualify this research from the current review category. You can create a modification by clicking Create Modification / CR within the study.

In conducting this study, you are required to follow the Investigator Manual dated April 1, 2015 (HRP-103), which can be found by navigating to the IRB Library.

Sincerely,



Thomas F. Byrd, MD
HRRC Chair

Appendix B:
Informed Consent

University of New Mexico Health Sciences Center
Informed Consent Cover Letter for Anonymous Surveys

STUDY TITLE
Minnesota Dentists' Opinion of the Dental Therapy Workforce Model

Christine Nathe from the Department of Dental Medicine, is conducting a research study. The purpose of the study is to quantify Minnesota dentists' opinions regarding the utilization of dental therapists in that state. You are being asked to participate in this study because you are actively licensed to practice dentistry in the state of Minnesota.

Your participation will involve completing a ten question survey. The survey should take about five minutes to complete. Your involvement in the study is voluntary, and you may choose not to participate. There are no names or identifying information associated with this survey. The survey includes questions such as do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree that dental therapists/advanced dental therapists help to alleviate the disparity in access to dental care. You can refuse to answer any of the questions at any time. There are no known risks in this study, but some individuals may experience discomfort when answering questions. All data will be destroyed once statistical analysis is complete.

The findings from this project will provide information on Minnesota dentists' opinion of the dental therapy workforce model. If published, results will be presented in summary form only.

If you have any questions about this research project, please feel free to call Christine Nathe at (505)272-8147. If you have questions regarding your legal rights as a research subject, you may call the UNMHSC Office of Human Research Protections at (505) 272-1129.

By completing this online survey, you will be agreeing to participate in the above described research study.

Thank you for your consideration.

Sincerely,

Christine Nathe, RDH, MS
Professor and Director
Division of Dental Hygiene
Vice Chair

HRRC# 17-337
Version Date 08/01/2017

HRPO #:

Page 1 of 1

Version:

Appendix C:
Recruitment Postcard

Opinion of the Dental Therapy Workforce Model

You have been randomly selected to participate in a ten-question research survey that aims to evaluate Minnesota Dentists' Opinion of the Dental Therapy Workforce Model. If you choose to participate you will be entered into a drawing for a \$200 Visa card.

Please utilize the following link to participate:

www.surveymonkey.com/mnd1

Thank you for your participation.

Christine Nathe, MS, Principal Investigator

Maggie Rogers, MS Candidate

University of New Mexico



IRB Approval: 17-337

If you have questions regarding your legal rights as a research subject, you may call the UNMHSC Office of Human Research Protections at (505) 272-1129.

Appendix D:

Survey

Survey on the Minnesota Dental Therapy Workforce Model

1. Please indicate your attitude toward dental therapists/advanced dental therapists performing the following procedures:

	Strongly oppose	Somewhat oppose	Neither Oppose or Favor	Somewhat favor	Strongly favor
Restoration of primary and permanent teeth					
Extractions of primary teeth					
Cavity preparation					
Placement of temporary restorations					
Placement and removal of space maintainers					
Placement of temporary crowns					

2. Please indicate your opinion to the following statements:

a. The employment of a dental therapist/advance dental therapist allows me to devote more time to complex procedures.

Strongly agree Somewhat agree Neither agree /disagree Somewhat disagree Strongly disagree

b. Dental therapists/advanced dental therapists help to alleviate the disparity in access to dental care.

Strongly agree Somewhat agree Neither agree /disagree Somewhat disagree Strongly disagree

3. Please indicate the number of years you have been in practice

1-10 years 11-20 years over 20 years

4. Which of the following best indicates your practice setting:

Solo Group Government Academic

5. If you are interested in entering a drawing for a \$200 Visa card, please provide your email address.

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