Training a Rural Oral Health Workforce

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Abstract

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Purpose: The Regional Initiatives in Dental Education (RIDE) program is an educational track of the University of Washington School of Dentistry (UWSoD) that aims to produce leaders who practice in rural areas of the Pacific Northwest. This study assesses outcomes of the first 10 years of the RIDE program. The hypotheses tested is that rural background is the most important predictor of long-term rural dental practice.

Methods: This descriptive study assessed existing data including graduates' location of practice, demographics, rurality of origin, parental occupation, and practice type over time. Subjects are all graduates of the RIDE program from 2011-2021 (N=80), represent all genders and range in age from 25-45 years. Statistical analyses were utilized to explore associations.

Results: Within the study sample 82% of graduates are practicing in a rural area, 32.5% of graduates pursued post-graduate dental training, 40% participate in Medicaid, and 78% are

practicing in the Pacific northwest. Statistical analysis demonstrated a strong association and medium to large effect sizes between both rural upbringing and training sites and established dental practice in a rural region.

Conclusions: Graduates of the RIDE program practice in rural areas in greater proportion compared to the general population of practicing dentists. RIDE graduates from the study period tended to be male, Caucasian, and practice in a Health Professional Shortage Area (HPSA) or rural site/clinic.

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II. INTRODUCTION

Rural health workforce shortage in medical and dental profession

In the United States, rural populations face many challenges accessing dental care which contributes to higher incidence of oral health complications, such as dental caries and permanent tooth loss, when compared to urban areas.[1] Within the U.S., there exist significant differences between the concentration and dispersion of population in urban and rural areas.[2] According to the U.S. Census Bureau, 19% of the U.S. population resides in rural regions, although it makes up 97% of the nation's land mass.[3] The remaining 81% of the U.S. population lives in urban areas, which comprise 3% of the nation's land mass.[3] The U.S. Census Bureau defines an "urban area" as having a population density of more than 1,000 people per square mile, and a population of 50,000 or more.[3] A "metropolitan area" refers to central counties with one or multiple urbanized regions of 50,000 individuals or more.[3] "Rural America" includes communities nearby metropolitan cities with populations under 50,000 and remote areas only accessible by traveling long distances from an urban area.[1] Rural residents are at a greater risk for both general and oral health problems. Tobacco use is more prevalent in rural communities and further increases risks of developing dental caries, periodontal disease, root decay and cancer.[4] The lower

socioeconomic status and lack of dental insurance in rural regions contributes to the growing oral healthcare crisis in these regions.[4]

Elderly populations in rural areas especially have lower rates of dental insurance and reduced access to dental care compared to their urban counterparts. A 2015 Oregon study described differences between the health and well-being of individuals over the age of 85 in a rural community in comparison to those living in urban cities. Some findings included: shorter lifespan and more medical and dental complexities (i.e., dental caries, periodontal disease, root caries, etc.) in the rural population.[4] The differences are primarily due to shortage of healthcare providers in rural communities, as people in rural communities usually travel greater distances for dental visits. A 2015 report from the Rural Health Research Center demonstrated the distribution of dentists in urban versus rural regions of the United States in 2008, reporting approximately 40 total practicing dentists per 100,000 individuals in urban areas, in comparison to only 24.3 dentists per 100,000 individuals in rural areas.[5] Lack of dental health care providers in remote areas reduces access to routine oral health screening and dental examinations, poorer dentition and higher dental pain, caries, and tooth extraction.[6] There are fewer dental specialists practicing in rural areas, which limits access to specialty services, even when preventive and community health services are available.[1] In addition, those living in rural communities tend to have lower income levels and rely primarily on well-water, leading to less fluoride exposure.[4] Solutions to improve rural dental health include preventative measures and public health interventions such as water fluoridation, inter-professional oral health education, preventative dental services, and caries risk assessments.[1] Furthermore, the implementation of school-based programs in conjunction with community health centers can increase access to preventive and community-based oral healthcare services for children in rural areas.[1]

Rural career incentivization strategies in medical and dental professions

A variety of strategies have been recommended to reduce disparities in access to dental care in rural areas such as preventative public health initiatives, mobile clinic services, financial incentives for health professionals (scholarships and loan repayment options), as well as academic program initiatives that includes rural community-based clinic experiences. A review by Shrivastava et al. of university-based initiatives targeting access to oral health care demonstrated that dental students benefit from rotating through clinical sites in more remote

regions.[6] These experiences allow students to expand clinical skills by treating advanced disease and promote working in a group setting to provide dental care in places that have much need. In the Shrivastava et al. study, the overall effectiveness of rural educational experiences varied between universities, depending on the amount of time that students spent at these remote sites and the quality of supervision.[6] In addition, this study reported participation in dental outreach programs enhanced students' realization of their own importance in the effort to bridge the gap in oral healthcare disparities.[6]

The concern of rural provider scarcity is also witnessed in the medical profession. Although some primary care physicians choose to practice in a rural setting, challenges remain both pre- and post-residency training, to maintain individual interests in rural practice.[7] According to Patterson et al., in comparison with U.S. urban populations, many rural residents experience greater burdens of healthcare needs, however, many rural regions face primacy healthcare shortages.[7] A systematic review examined factors that may discourage medical school graduates from pursuing careers in rural areas, including demanding working hours and conditions, insufficient medical equipment and facilities, inadequate opportunities for personal and professional growth, as well as lack of educational opportunities for children and safety concerns.[7] Previous research has shown that exposure of resident physicians to rural clinical experiences is a strong predictor for promoting future rural practice.[7] Both rural-centric and rural training track (RTT) medical residency programs aim to attract physician residents with a strong interest in pursuing a career in rural practice.[8] The RTT model prepares its medical resident graduates for rural practice by combining up to 1 year of urban training with 2 years of rural training.[8] According to a report by the Washington, Wyoming, Alaska, Montana, Idaho (WWAMI) Rural Health Research Center, approximately 56% of RTT graduates, who are trained at various clinics across the U.S., provided health care in Health Professional Shortage Areas (HPSAs) one-year post-graduation and nearly 50% were still in HPSA site seven years post-graduation.[8] HPSAs are areas, both rural and urban, with a shortage of healthcare providers as defined by federal government criteria. Specific populations such as those with significantly high needs for health services, and certain facilities (such as a community health center) may also be a designated HPSA site.[9] The HPSA designation is based on the ratios of provider per population and scores range from 0 to 25 for primary care and mental health, and from 0 to 26 for dental care, with a higher score indicating a greater shortage area.[9]

Similarly, the recruitment of newly graduated dentists to rural and underserved regions can be challenging, in part due to lack of awareness and training in providing care to these populations. Access to oral healthcare is a multifactorial and significant concern in most rural communities and recruitment and retention of rural dental health professionals is a significant problem in the United States. Contributing factors for these shortages include geographic location, population and infrastructure, the students' rural background, loan repayment options and grants that mandate graduates to return and provide care in rural areas, as well as mentorship and career opportunities. The 2016 Health Resources and Service Administration (HRSA) report, titled, 'what is shortage designation' stated over 10,000 additional dentists are needed to meet the needs of the population in these regions.[10,35] When recruiting healthcare providers to work in a rural community, several key factors have been identified as important in recruitment and retention.[1] These factors include rural background of the provider, lower educational debt, rural/community-based training opportunities while in professional school, lower cost of living and practice ownership opportunities.[1] The cost of dental education in the United States has significantly increased over the last 20 years.[10] According to the American Dental Education Association (ADEA), the average education debt for all dental school graduates in the Class of 2021 was $301,583, with the average for public and private schools at $261,226 and $354,901 respectively.[30] The significant loan burden that many dental students accumulate may deter many from pursuing employment in rural communities when higher paying jobs exist in more suburban and urban places. However, opportunities for loan repayments and scholarships are promising ways to attract new graduates to fill the rural healthcare gap. The National Health Service Corps (NHSC) has scholarships and loan repayment options available to health professionals who choose to provide care in specified rural sites.[1] The NHSC, a clinician recruitment and retention program, is designed to reduce the health workforce shortages in the rural and underserved regions.[9] The components of NHSC include a federal scholarship program, a federal loan repayment program and a state-operated loan repayment program, and with each of these programs, the healthcare provider receives either a loan repayment or a scholarship, in exchange for a service commitment at an NHSC approved facility located in a federally designed HPSA site.[9] The loan repayment can help the financial burden of dental school faced by many new graduates.

Recruitment initiatives by the U.S. government to attract healthcare providers to rural practice include financial incentives, loan repayment programs, recruiting graduates from rural regions, work visa incentives for foreign trained dentists and establishing dental schools in rural communities.[10] Government subsidized loan repayment programs, introduced in 1992, were designed to improve the distribution of loans to post-secondary education students in need of additional financial assistance. Public service loan forgiveness (PSLF), a form of government subsidized loan repayment program implemented since 2007, allows qualifying federal student loans to be forgiven after 120 qualifying payments (totaling 10 years), while working for a qualifying public service employer such as a government service (such as community health center) or certain non-profit organizations.[12] For example, the Federal Loan Repayment Program offers $50,000 towards loan repayment for a 2-year commitment in a community health setting, and the Indian Health Service Loan Repayment, offers $40,000 for a 2-year commitment.[10] Although there is improved short-term retention based upon these incentives, the long-term retention rates are low.[10] Retention of healthcare professionals, including dentists and dental specialists, in rural communities remains a significant problem in the United States, although the number of pediatric dentists in the Western U.S. increased 87% between 2000 and 2010, the number of pediatric dentists in rural regions increased only by 5.4%.[10] Previous studies have reported approximately 85% of general dentists do not feel competent to practice with the pediatric dental population, which further impedes access to oral care for children in rural communities.[10]

The intention of a 2019 cross-sectional study by Alrayyes et al., was to assess the ability of the Government Subsidized Loan Repayment Programs (GSLRPs) in recruiting pediatric dental specialists to take employment in rural, underserved regions and to evaluate the variables influencing their choice of employment location.[10] Eighty five percent of respondents reported having student loan debt.[10] Although 41% of the respondents showed interest in pursuing job opportunities in rural areas, only 4% intended to pursue such careers. Respondents also expressed willingness to practice in rural areas if the loan repayment amount was increased by $10,000-30,000.[10] The average GSLPR is approximately $30,000 annually.[10] Although slightly more than 14% of respondents stated that no amount could convince them to consider practicing in rural areas, over half indicated willingness to consider this if the GSLPR were $40,000-$60,000 annually.[10] This study demonstrated that financial incentives may help encourage new

dental graduates to practice in underserved, rural areas, however, the current GSLPRs available are not sufficient.[10] One significant finding of the Alrayyes et al., study was that having a rural background increased the likelihood of the pediatric dentists to pursue practice in a rural area post-graduation.[10] This study also suggested that academic establishments should provide more information regarding student loan repayment options to residents, since many residents were not familiar with available loan repayment programs.

Rurality of upbringing and choice of rural healthcare practice

In 2010 the World Health Organization (WHO) issued a global recommendation to improve the retention and the recruitment of health care providers, specifically in remote, rural, and underserved locations. The WHO recommendation included increased enrollment of students with rural backgrounds and imposing clinical rotations in rural areas during students' education.[13] Many interventions have been implemented globally to increase the rural healthcare workforce; however, the two most successful strategies reported are recruitment of students from rural upbringings and clinical teaching programs in rural sites. These strategies demonstrate success with student involvement in rural communities and multidisciplinary healthcare.[13]

A 2016 meta-analysis of dental education and practice by Suphanchaimat et al. demonstrated that the combined odds ratio of rural educational exposure on the intention to work in a remote, rural area was approximately 4.1.[13] When evaluating the intervention groups, the clinical rotations in rural areas were slightly more influential than the recruitment of dental students from rural backgrounds.[13] The reported finding is perhaps linked to students' positive experiences practicing in underserved communities, along with experiences managing complex health needs. Implementing clinical rotations in rural communities during dental school and targeting enrollment of students with rural backgrounds are both effective strategies to address the deficiency of dental healthcare practitioners in rural, underserved locations.[13]

There are various factors influencing recent graduates to pursue careers in rural regions, such as rigorous and extensive dental clinical exposure, challenging patient population, supportive professional network and community, rural lifestyle, as well as financial incentives and loan repayment options.[16] The impact of graduates' rural background and upbringing on employment outcomes is not well described in the field of dentistry. Although it is still unclear in current literature whether the impact of graduates' rural background is a significant factor in

employment outcomes, with some reporting a strong influence in long-term retention rates,[17,18,19] while others suggest minimal impact on overall remote employment retention.[20,21] The relatively small number of publications report stronger independent predictors of prior rural experiences and pre-placement rural intentions.[14]

Dental education & practice choice

The U.S. dental schools, particularly those that receive state-budgeted support and funding, are among many agencies that are striving to address the concerns surrounding oral health and ensuring reasonable access to care across the state.[2] States that are home to dental schools are especially interested in sufficient workforce distribution to better serve their residents.[2] The choice of practice location immediately following dental school graduation, is one of the many data variables that the American Dental Education Association (ADEA) routinely collects.[2] Wanchek et al. reported the annual ADEA survey of 2017 graduating dental students and found that merely 6.9% of the dental school graduates intended to begin working in a rural setting following their education.[20]

Reinhardt et al. aimed to examine demographics of the University of Nebraska Medical Center (UNMC) College of Dentistry graduates within the last 10-year period (2009 to 2018), as well as aspects that related to the graduates' choice of practice immediately following graduation.[2] The study analyzed factors such as individuals' age at graduation from dental school, gender, rural or urban high school graduation location, their state of residence at high school graduation, in addition to various other background information to evaluate associations with their most recent (2018) practice location.[2] The study defined a 'rural' region as having less than 50,000 individuals.[2] The study demonstrated that of the UNMC dental school graduates from the periods of 2009 to 2018, 169 (37% of the total graduates) chose to practice in the state of Nebraska.[2] Of the 169 who selected Nebraska as their home practice state, 71 of them were working in rural practices and 96 of them came from a rural background, as stated by their high school graduation location.[2] One additional variable that the study reported was retention of the out of state graduates in rural regions of Nebraska. The authors noted a much lower proportion of non-Nebraskans working in rural locations compared to in-state residents.[2] Lastly, another significant finding in the study was that a higher proportion of men than women chose rural practice, 50% and 33% respectively.[2] Younger age, in-state residency status, graduating from a

rural high school, and being male were all associated with UNMC College of Dentistry graduates working in rural Nebraska regions from 2009-2018.[2]

Community Based Dental Education (CBDE)

Community-based teaching is largely supported in current dental education and involves dental students receiving dental training and knowledge in community clinics, as well as private dental offices outside of the dental school campus.[17,22] Most fourth-year dental students in the United States part-take in multiple week external clinical rotation in underserved and/or low-income settings outside of the dental school environment.[22] The primary aim of the CBDE model is to address access to oral health care in rural and underserved settings, and to use experiential learning in hopes of encouraging dental school graduates to pursue careers in low-income and rural communities.[22] Mays et al. highlighted that having community-based educational component is a strong predictor and influencing factor for seeking employment in a similar setting and environment.[22] In addition, exposure time of CBDE experience for at least 8 weeks additionally enhanced the education experiences for dental students and helped to promote community commitment.[22] At Virginia Commonwealth University, dental students demonstrated increased confidence in being able to treat pediatric patients following their CBDE experience.[17] A study from Harvard School of Dental medicine depicted that a 12-week long CBDE experience was crucial in helping students' understanding of the health care system and its intent to include community health and outreach services into their future dental practices.[17] Major et al. suggested that having exposure to low-income populations, specifically working with Medicaid patients did not correlate to inclination and motivation to treat these populations.[23] This finding was particularly significant since it demonstrated that simply exposing students to the Medicaid patient population may not be sufficient to shape their willingness to practice in a rural and underserved community.

The primary aim of the 2019 Mays et al. study was to determine the relationship between dental students' anticipated location of practice and their hometown size and to evaluate any potential influence their CBDE experience in a rural setting had on their practice location plans.[17] From the years 2016 to 2018, senior year dental students at the University of Minnesota School of Dentistry completed a ten-item questionnaire (pertaining to gender, student type, ideal future geographic practice location, etc.) both prior to and after completion of their 4-weeklong

rotations at a rural clinic site, the Rice Regional Dental Clinic (RRDC), which is housed in the Carris Health Hospital, an affiliate clinical site for the University of Minnesota School of Dentistry.[17] Results showed that prior to the community health center rotation, 58.6% reported one of the rural locations as an ideal practice site, but that percentage then increased to 61.4% following the rotation. The difference was not statistically significant ($p=0.984$).[17] However, following the RRDC rotation, there was a slight increase for women dentists intending to practice in a "small town", which was statistically significant ($p < 0.05$).[17] The majority (75%) of the dental students' respondents shared that they had positive experiences at the RRDC and would recommend it to a friend and/or colleague.[17] Although this study did not strongly associate dental student's rural practice intent with community-based clinical experience there was strong indication that students who came from rural communities prior to attending college had intention to practice in a rural community.[17]

Dental schools that actively recruit students committed to work in rural settings and reinforce this message by emphasizing exposure to rural practices and community based clinical experiences is one strategy to address these shortage of dental health providers in rural communities.[24] In 2016 the University of Minnesota School of Dentistry received funding from U.S. Health Resources and Services Administration, which supported development of a three-week training program specifically for practicing in rural communities, which is still being implemented today.[24] Dental students must complete the first year of dental school in order to qualify for the Minnesota School of Dentistry Collaborative Rural Oral Health Project (MN-CROHP).[24] This elective, a three-week long mentorship program selects 20 dental students and pairs them with a dentist who is practicing in a rural region within the state.[24] Following the successful completion of their first year of dental school curriculum, students are eligible to participate in this MN-CROHP program, which occurs in the months of July and August.[24] Finally, in addition to receiving a $1500 scholarship, the selected individuals must take part in the Rural Dentistry Scholars one credit course.[24] The rural training program is led by mentors from the Minnesota Dental Association who are selected based on their location of practice and leadership qualities.[24] Increased clinical opportunities promoted student skills and management of larger patient volume while working closely with mentors and leaders in rural dentistry. The amount of time students spent with mentors in rural clinics fostered a stronger sense of the role that dental healthcare providers play in reducing health disparities.[24] The University of

Minnesota School of Dentistry has been a pioneer in implementing programs to address shortages of oral healthcare professionals in rural regions.[24] The school takes into consideration applicants' rural origins when selecting their students, and as part of the school's dental curriculum, 4th year dental students complete a mandatory, nine-week long rotation in a rural region.[24] Encouraging collaborative learning and providing community-based rotations and clinical opportunities in dental school may motivate graduates from various dental schools across the U.S. to pursue dental practice in rural areas.[24]

East Carolina University School of Dentistry implements the CBDE model of teaching in order to help increase the number of dentists practicing in rural and underserved regions of North Carolina.[22] All students participate in three, 8-week long rotations at Community Service-Learning Centers (CSLCs) during their final year of dental school, prior to graduation and matriculation into the workforce.[22] The CSLS are ECU School of Dentistry clinic sites, the majority of which are in counties designated as a dental Health Professional Shortage Area (HPSA) region.[22] Most of the counties in the state of North Carolina are considered Dental (HPSA) sites.[22] ECU students attend 3 different CSLC sites, and the dental school attempts to ensure that at least one of the students' rotations is in a county near their hometown, to further encourage them to seek employment in underserved regions within North Carolina.[22]

Gordon et al. evaluated the practice intentions before and after CBDE experience during students' final year at the ECU School of Dentistry.[22] All the data were obtained from students in three graduating years (2015- 2017), which included written student reflections and self-reported practice plans upon graduation.[22] All dental students at ECU were required to participate in the Community Oral Health Practice (COHP) course, which was intended to prepare graduates for community-based practice in rural and underserved regions across the state.[22] The results of the study found relatively positive attitudes towards the CBDE education program before and after participation during the final year of dental school.[22] Students' reflections confirmed that most of them entered the CBDE practice with expectations consistent with their strong motivations for applying to dental school, shared positive experiences about the CSLC rotations and most wanted to remain in the state of North Carolina and enhance the access to oral health care within the state.[22] When surveying the alumni, a large majority (92%) of respondents shared positive attitudes about the rotation and many (over 90%) felt well-prepared to begin practicing in rural communities and serve the underserved population.[22] Over 60% of the alumni respondents

remained in the state of North Carolina after graduation, with half practicing in rural and underserved regions.[22]

The findings in the ECU study are consistent with those from various other dental schools within the United States such as A.T. Still University (ATSU), University of Michigan and West Virginia University.[22] In all three universities, the CBDE component of student's dental school education has been an asset in their education and has positively affected student interest in practicing at community-based dental clinics in rural & underserved regions in their respective states. For instance, at the University of Michigan, by increasing the length of the CBDE rotation from 3-5 weeks to up to 8 weeks, the percentage of dental students who chose a community-based dental practice as their primary choice following graduation increased from 5.6% to 16.5% within the years 2008 to 2010.[22]

The University of Colorado has established an interdisciplinary pathway for its students in various professional fields, after discovering that over half of the rural dentists and physicians in the state of Colorado were raised in rural regions.[25] The Rural Track program at the University of Colorado was founded in 2005 and its goal is to provide future healthcare providers with knowledge, clinical and didactic skills, and support from like-minded faculty, to best serve the rural communities in the state of Colorado.[25] Follow-up data from 2009-2019 for these students' post-graduation show that 51% of Rural Track graduates are practicing in the state of Colorado and 40% of its graduates are practicing in rural communities within the state.[25]

Regional Initiatives in Dental Education (RIDE) Program

In the state of Washington access to dental care in urban areas is far greater than that of rural communities.[4] King County, which is home to Seattle, has six times as many dental providers per capita as Pend Oreille County, located in the state's rural northeast corner.[4] Cultivating graduates committed to rural dental practice is a foundational principle of the University of Washington School of Dentistry Regional Initiatives in Dental Education (RIDE) program. Initiated in 2007, RIDE is operated in conjunction with Eastern Washington University (EWU) and the University of Washington School of Medicine WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) program in Spokane. The primary aim of the RIDE program is to reduce disparities between rural and urban communities in the Pacific Northwest accessing oral health and dental services.[4] According to the 2012 Washington State Dental

Association (WSDA) Report, 92% of dental providers in the state of Washington practice in urban area, leaving many rural regions dangerously underserved (Figure 23).[34] RIDE enrolls cohorts of approximately eight students annually as an educational track of the University of Washington School of Dentistry (UWSoD). The program provides rigorous community-based education both clinically and didactically that prepares dentists to serve rural and underserved communities and to be leaders in their field.[4] RIDE increases access to quality dental care in rural communities and regions and improves the oral health care system by producing team-oriented professionals.

RIDE students begin dental school with a week-long orientation in Seattle at the University of Washington, followed by a 5-week long Early Clinical Emersion (ECI) course. This provides the RIDE students with an opportunity to interact with other RIDE classmates, explore the basics of clinical dentistry, as well as experience the Seattle campus. Following the ECI course, RIDE students move to the Riverpoint campus in Spokane, Eastern Washington University, where they spend the remaining 1st year of dental school.[26] RIDE students maintain communication with the UWSoD Seattle campus through distance-learning technologies, which allows them to virtually attend many courses with their colleagues from Seattle campus. Distance learning is a fundamental tool that the RIDE program uses to deliver courses and information across the participating site locations. Distance communication technology fosters ongoing relationships between these campuses and enhances educational equivalency. Additionally, the favorable student to faculty ratio at EWU allows for small group collaboration and learning facilitated by the faculty.[26] Following summer after their first year, the RIDE students take part in the Rural Underserved Opportunities Program (RUOP), a 4-week long, immersion experience where the RIDE students rotate at affiliated Community Health Center (CHC) and Federally Qualified Health Center (FQHC) dental clinics in rural regions of Central or Eastern Washington (Spokane, Colville, Okanogan, Othello, Moses Lake, Wenatchee, Chelan Yakima, and others) (Figure 1).[4] Students spend these 4 weeks actively assisting, learning, and even engaging in clinical activities, including providing local anesthesia to patients following completion of an early course in dental anesthesia.[26] After the completion of the 4-week long RUOP rotation, RIDE students return to UWSoD Seattle campus, where they spend the 2nd and 3rd years of dental school education and continue building clinical skills by participating in comprehensive care clinical training models. During the final year of dental school, after the completion of the

fall quarter at UWSoD Seattle campus, RIDE students return to Central or Eastern Washington and spend their winter and spring quarters in Community Health Center sites (Figure 1), improving upon clinical and professional skills with the guidance of UW affiliate faculty members. In comparison to students at UW Seattle campus, who see typically two to three patients per day, RIDE students encounter six to eight patients daily (of various ages and backgrounds) in most FQHC sites and thus develop clinical skills efficiently.[4]

The collaborative education model is a key component of the RIDE program. Rural providers must understand the strong relationship between an individual's oral and overall health, and collaborate with other healthcare professionals (i.e., primary care physicians, nurses, pharmacists, social work specialist, dental hygienists, etc.) to ensure comprehensive care in the rural setting.[4] RIDE works closely with UW School of Medicine's regional education program, which includes 7 regional training sites in Washington, Wyoming, Alaska, Montana, and Idaho (WWAMI).[26] According to Ballweg et al. UWSoM's considerable institutional knowledge with regional education has significantly impacted the success of the RIDE dental program.[26] During the first year of dental school, while at the Eastern Washington campus, RIDE students participate in foundational courses in gross anatomy, histology, and embryology alongside the medical students.[26] Collaboration with the UWSoM, allows RIDE students to participate in 'Introduction to Clinical Medicine' course with medical students, which requires students to interview hospitalized patients and helps to develop communication skills and professionalism that are needed to pursue careers in diverse populations following graduation.[26] While at the Spokane campus, RIDE students also take part in an additional course with the medical students titled, 'Medical Information for Decision Making,' a course designed to improve the students' ability to evaluate evidence in biomedical literature.[26] This is an important step towards establishing an integrated care system for future professionals by bridging the gap between clinicians so they can improve health outcomes for all patients.

The partnership between the EWU's School of Dental Hygiene and RIDE supports interprofessional education for dental students and dental hygiene students, promoting team building and collaborative oral healthcare.[26] In Spokane, RIDE students participate in fundamental dental courses alongside the dental hygiene students, such as the 'Introduction to Clinical Dentistry' and 'Periodontology.'[26] The primary goal of this collaboration is to develop

and promote interprofessional and communication skills, and most importantly to improve patient care by delivering multidisciplinary approaches to dental care.

Applicants to the RIDE program are partially self-selected, as they knowingly prioritize an educational experience focusing on rural location, hybrid learning technologies, and interprofessional educational models. The RIDE program emphasizes challenges that rural communities face accessing dental care, providing students with rigorous educational and clinical experiences, and preparing them to serve the needs of the rural populations across the state of Washington.[4] By spending a significant amount of time in these rural communities and health centers RIDE students form a network with dental health care professionals practicing in rural settings prior to graduation.[4] In addition, RIDE students learn about loan repayment programs as an important incentive for those committed to practicing in rural regions and communities.[4] Dental students graduating from the University of Washington have an average debt of $255,000.[11] As described in Nicholson et al. study, many dental students lack awareness of loan repayment options available to graduates.[27] Loan repayment programs may be a strong contributing factor and an incentive for many future dental graduates, considering that the cost of dental education has been gradually increasing (averaging $301,583 nationally) and will continue to do so in the coming years.[20]

RIDE has paved the way for additional developments at various sites and nearby states of Washington, Wyoming, Alaska, Montana, and Idaho (WWAMI).[4] The Montana University System, led by the Office of the Commissioner of Higher Education has put forth a state legislative funding proposal for the 2023-2025 biennium that includes creating a collaborative Doctor of Dental Surgery (DDS) degree program track in Montana. The program, called Regional Initiatives in Dental Education (RIDE) would be housed at Montana State University, Eastern Washington University, and the University of Washington. The program curriculum is primarily administered out of the University of Washington. This proposal is currently being discussed in the Montana State Legislative Session (concluding at the end of April 2023). Enrolled students would spend 1st year of instruction at Montana State University (MSU) and summer Montana Clinical Rotation, 2nd year at EWU-Spokane, 3rd year at UW-Seattle, and 4th year at Montana Extended Clinical Rotation in a rural Montana community. For the last 6 years, UW DDS non-RIDE, Seattle based students have attended 5-week clinical service-learning rotations in Montana at 12 different locations through a series of HRSA grants. The RIDE

program addresses the critical shortage of dental healthcare in rural communities, especially in the WWAMI region, by selecting students who show interest and desire in wanting to work in rural regions and providing them with educational and clinical tools to succeed.[26]

Recruitment and retention concerns

Through previous research, the American Dental Association (ADA) Health Policy Institute (HPI) has analyzed data for every dental school in the United States pertaining to how many dental graduates choose to practice in rural regions post-graduation, as well as how many graduates stayed in the same state that they received their dental education in. A lot of variations were observed.[19] In particular, the University of Nebraska Medical Center (UNMC) had the highest percentage (32%) of graduates practicing in rural and underserved regions in the state post-graduation, in comparison to Columbia University College of Dental Medicine, which had the lower percentage (1%).[19] With regards to number of individuals who chose to stay and practice in the state that they received their dental education in, the School of Dentistry at University of Texas Health Science Center at Houston had the highest percentage (89%), whereas Creighton University Dental School in Nebraska, had the lowest, with only 10% of its graduated choosing to practice in the state.[19] Public schools are generally funded by local, state, or federal government in hopes of addressing the cost of dental education, whereas private schools are typically supported through higher tuition rates paid by students.[19]

The concern of recruitment and retention was further studied for the School of Dentistry at Virginia Commonwealth University (VCU), by examining the association between the location of a dental student's hometown (rural vs. urban) and the likelihood of choosing to practice in a rural and underserved region post-graduation.[19] The examiners used the ADA Masterfile date pertaining to dentistry practice location and occupation for all practicing dentists and extrapolated the data for VCU School of Dentistry graduates from the years 2000 to 2014.[19] The school defined a rural status to be those students from the western and southern parts of Virginia, excluding the higher populated urban cities of Roanoke and Salem.[19] Analyzed a total of 964 of these graduates who were currently practicing, as well as their location of hometown prior to starting dental school.[19] Rural-Urban Commuting Area (RUCA) codes were compiled through individual's zip code data, to categorize the addresses as rural or urban.[19] Rural Urban Commuting Area (RUCA) codes are a census, tract-based classification, which uses census

measures of population density, urbanization, and daily commuting to characterize all U.S. census tracts respective to their rural/urban status.[28] A higher RUCA score/number is indicative of more rurality (Reference Table 3 in the RUCA guide document). In addition, 70% of the VCU Dental School graduates from 2000 to 2014 were residents of Virginia at time of enrollment.[19]

The study emphasized two significant findings. First, VCU graduates from rural regions of Virginia were more likely to remain in the state of Virginia than those individuals from urban areas[19]. Secondly, those students who are originally from rural regions of Virginia were 3 times more likely to practice in a rural area (18%), in comparison to the dental school graduates who were from urban communities (6%).[19] The findings indicate that the location and state of one's upbringing plays a large role in determining where they pursue employment following dental school graduation.

These analyses are critical in tackling the maldistribution of dental workforce that contributes to poor access of oral and general health care. Previous studies have proposed the notion that one method of attracting new dental graduates to practice in rural areas is to recruit more students from rural areas.[19] Hence, schools such as the Eastern Carolina University (ECU) School of Dentistry, as well as VCU have placed greater emphasis on the recruitment and enrollment of prospective dental students, to address the access to dental care issues in rural and underserved areas across their respective states.[19] Previous research has reported that the most critical aspects in choosing the private sector are a broad range of clinical experiences, opportunities for future ownership, as well as continuity of care, whereas the primary reasons for considering the public sector include work environment and clinical mentoring.[15] Previous data has demonstrated that community-based dental education (CBDE) helps to improve students' confidence and prepares them to be well-trained health care professionals.[22] Although CBDE has influenced many students' intention to practice in rural regions and has significantly improved their ability to provide care for individuals in low-income and underserved populations, it is unclear as to which specific components of these community rotations encourage dental students to pursue careers in rural and underserved regions.[17]

There has been conflicting and inconsistent data presented in previous studies pertaining to one's sex and in-state residency impacting their decision to seek a career in rural and underserved regions.[2] Whereas McFarland et al. stated that non-residents who remained in the state of Nebraska following dental school graduation, were more likely to locate in a rural

community than were residents, implying that the contributing factor may be that dental students are most likely to locate in the state where they completed their dental education.[20] Additionally, Mays et al. reported that although the study found that students' intent to practice in a rural region was not altered by a clinical rotation, there was still strong evidence that suggested students from rural regions prior to attending college, had strong intentions to seek careers in a rural and underserved communities.[17]

Given that recruitment and retention of healthcare professionals, particularly oral health workforce is a significant health policy concern that is observed in both low and high-income countries, it has lasting impact on many individuals across the United States.[19] The RIDE program is successful in part because it clearly addresses challenges to recruiting and retaining dentists in underserved and rural areas.[4] RIDE identifies self-selected individuals who are attracted to rural practice and provides them with a rigorous and thorough educational program, both didactic and clinical, so that these individuals are ready to effectively work in underserved regions within the state of Washington.[4] RIDE students get the opportunity to work with mentors and faculty members who have devoted their careers to provide care in these rural and underserved regions.[4] Therefore, the philosophy of selecting students who demonstrate strong interest in serving in rural practice following graduation and exposing them to community-based clinics and mentors, RIDE has taken major steps in addressing oral healthcare needs of the rural population.[4]

Current Study

The purpose of this study is to assess the outcomes of the University of Washington School of Dentistry's Regional Initiatives in Dental Education (RIDE) program for the first ten years of graduates (graduating classes 2012-2021). The hypothesis tested is that rural background of the dental student is the most important predictor of long-term rural dental practice among the first 10 years of RIDE graduates.

III. METHODS

This study was reviewed by the Institutional review board (IRB) at the University of Washington and was exempted due to the nature of the study. According to the U.S. Department

of Education, the Family Education Rights and Privacy Act (FERPA) is a federal law that seeks to protect the privacy of students' education records.[29] Schools and institutions must have written permission from the parent or the eligible student to release any information from the student's educational record.[29] However, FERPA allows schools and universities to disclose these records without consent under the following conditions: specified officials for audit or evaluation purposes, organizations conducting research studies on behalf of the school/program, etc.[29] This study complied with FERPA requirements by using anonymized data that was reviewed and approved by the UW Office of the Registrar prior to data analysis. This is a retrospective descriptive study providing a summative assessment of existing data about RIDE dental graduates at the UW School of Dentistry during the years 2012-2021.

Statistical Analysis

The de-identified data was imported into R studio (v. 2022.12.0.353) and analyzed using R statistical software (v 4.2.2). Descriptive statistics for categorical and dichotomous variables were assessed using the tbl_summary() function as part of the "gtsummary" package (v. 1.7.0). The Fishers Exact test was performed using the fisher_test() function as part of the "rstatix" package (v. 0.7.1) and was adjusted for False Discovery Rate for multiple testing.[32] Effect size of the association was assessed using the Cramer's V statistic with the cramer_v() function from Cohens D statistic using the chones_d() function within the "rstatix" package (v. 0.7.1) (Appendix III).

Sampling and recruitment

Subjects (N=80) are graduates of the UW School of Dentistry Regional Initiatives in Dental Education (RIDE) program from 2012-2021. The subjects are all genders and range in age from 25-45 years. No subjects were recruited, rather an existing database maintained by the RIDE program was used for data collection and analysis. The inclusion criteria consisted of: (1) all graduates of the RIDE program from 2012-2021, the study group. Exclusion criteria is anyone who is not a graduate of the RIDE program during the study period.

Data Collection

The existing database for RIDE graduates is maintained by the University of Washington School of Dentistry, 1959 NE Pacific St., Seattle WA 98115. Data review and statistical analysis was performed at this location and at the Center for Pediatric Dentistry, 6222 NE 74th St. Seattle WA 98115. Research is predominantly data analysis/review and did not require direct interaction with subjects. School records are protected by the Family Educational Rights and Privacy Act (FERPA). Graduates of RIDE are contacted annually by the administrators of the RIDE program with a request to submit a brief survey. These annual surveys are used to track the location of practice of RIDE graduates by the program administrators. Members of the study team have worked with the subjects in the past during the students' educational program at the University of Washington School of Dentistry in the roles of administrative support and faculty. Select members of the research team who are affiliated with the RIDE program have direct access to information about the subjects including subject name, date of birth, address at time of application to dental school, addresses over the time of the study period. For the purposes of this study, a de-identified data set was used to perform data analysis. Data was de-identified and approved by the UW Office of the Registrar before being analyzed by the authors AM, KK, and AF. All data sets used for this research were de-identified and stored on password protected UW software One Drive. Only the RIDE administrators and authors FR and NF maintain the link to the de-identified data as part of routine program assessment and recordkeeping.

Data used for this study includes demographics of physical location of practice, graduating class year, RIDE provenance during dental school, practice of dentistry or specialty residency, sex, ethnicity, year of birth and practice address (city, state, zip code and county). Additional analysis of variables includes practice location in (i) Community Health Center (CHC), (ii) Health Professional Shortage Area (HPSA), and (iii) Rural-Urban Commuting Area (RUCA) Code; self-reported Medicaid proportion of patient population, post-graduate training and self-reported leadership. RIDE provenance is a combination of self-reported hometown location and admissions student date information. RIDE administration defines hometown as where a student spent majority of their formative years, a good benchmark was where they learned to drive. It is the best answer to where a student is originally from.

Rural Urban Commuting Area (RUCA) codes are a census, tract-based classification, which uses census measures of population density, urbanization, and daily commuting to characterize all U.S. census tracts respective to their rural/urban status (Table 2). In this study,

ZIP codes census database was used to assign a RUCA code score. In the RUCA classification system, each ZIP code is assigned to a primary code between 1 and 10, depending on its characteristics such as Metropolitan/Urban (50,000 or more), Micropolitan/Large Town (10,000 - 49,999), Small town (2,500 - 9,999), or Rural/ Isolated (under 2,500). Higher RUCA score/number is indicative of more rurality. RUCA scores were compiled by using 'USDA Economic Research Service U.S. Department of Agriculture' zip-code file (last update in 8/17/2020). For purposes of the project, Small town and Rural/ Isolated are grouped separately and rural is defined as (RUCA code 10), with the population below 2,500 people (Appendix I and II).

The primary outcomes of interest in the study include rural practice, practice in a community health center (CHC), practice in a HPSA area, and remaining in rural/CHC/HPSA practice over time. The assessed variables included: rural upbringing, where the students completed their clinical training sites, in state vs. out-of-state status, and demographics. Data was analyzed to assess the relationship between where the University of Washington RIDE dental students come from, using the parental home ZIP code and RIDE provenance data information (rural upbringing), and their likelihood of choosing to practice in a rural area after-graduation (current practice location/ZIP code). Also examined was in-state and out-of-state retention rate post-graduation in Washington and/or the WWAMI region. Statistical analysis was done to determine whether there is any association between the RIDE training sites (Rural and Underserved Opportunities Program – RUOP, and Service-Learning Rotation – SLR) and rural practice in Washington state or a WWAMI region post-graduation. Additional data were analyzed to assess student's ethnicity and correlation to choosing rural practice, to determine the percentage of in-state vs. out-of-state students, and to evaluate percentage of male and female RIDE dental students who chose to practice in rural Washington following graduation, which did not require statistical analysis.

IV. RESULTS

The study's target population comprised 80 RIDE students who matriculated at the University of Washington School of Dentistry, between 2012 and 2021 (approximately 8

students per cohort/year). Both statistical and non-statistical data analysis was completed in studying the findings.

Descriptive findings – Demographics

Table 1 displays demographic data for University of Washington School of Dentistry RIDE participants (2012 – 2021) N=80. Fifty (63%) of the participants were male and 30 (37%) were female (Figure 5). Twenty-three out of 30 (77%) females and 39 out of 50 (78%) males were practicing in rural and underserved regions, including Health Professional Shortage Areas (HPSA) sites and Community Health Clinics (CHC) at the time of data analysis (Figures 6, 7). The majority of the RIDE participants during this study period, 54 (68%) were between the ages of 25-29 and only one individual (1%) from 2015 Cohort 4 was over the age of 40. Counties were divided by regions for ease of presentation and data analysis using Washington Office of Governor (Figure 4), with Puget Sound (21%), Out of State (OOS) (20%), North Central (15%) and East (14%) comprising the majority of the counties represented (Table 1).

Rural upbringing was extrapolated by RIDE Provenance and home/parental ZIP code; analysis shown in Table 1. Figure 2 shows a map of rural and urban counties according to Washington State Department of Health, which was used to analyze the data and note any significant findings. Twenty-seven subjects (34%) were from a rural county/region, whereas 28 (35%) were not, 10 (13%) were out-of-state and for 15 (19%) no information was available pertaining to parental zip code. Finally, specialty training was evaluated and determined that 26 (32.5%) of graduates pursued post-graduate dental training, whereas 54 (68%) did not. Figure 7 shows these statistics, and Figure 8 highlights this distribution of the 26 students who pursued residency/specialty training post-graduation, 12 (46%) went into Advanced Education in General Dentistry (AEGD) and General Practice Residency (GPR), 4 (15%) went into Pediatric Dentistry and 3 (11.5%) pursued Oral & Maxillofacial Surgery (OMFS), with the remaining students pursuing specialty training in the fields of Periodontics, Endodontics, Orthodontics and Anesthesia.

Table 3 depicts additional variables of interests including ethnicity, parental occupation, location of high school and leadership roles. As shown in Table 3 and Figure 9, fifty-seven out of

80 (71%) were Caucasian, 13 (16%) were of Hispanic descent and 8 (13%) were of Asian descent. The International Standard Classification of Occupations (ISCO-08)[36] was utilized to categorize the variable of parental occupations Manager (10%), Not seeking employment (15%) and Professional (22%) comprised nearly half of the parental occupations (Table 3 and Figure 10). Eighty seven percent of subjects that attended high school in Washington were practicing in a WWAMI region (Figure 11). The U.S. regions of Northeast, Southeast, Midwest, Southwest and West (Figure 12) were utilized when examining RIDE graduates home location (HS state) and their current practice location (Figure 13). One individual's home location was identified as foreign, which was excluded from the analysis (n=79). An overwhelming majority of subjects practice in their home region.

Table 4 displays Community Health Center (CHC), Health Professional Shortage Areas (HPSA) and Self-reported Medicaid data for subjects dental practice Figure 14 excludes the N/A results, therefore 59 (80%) are not working in a Community Health Center, whereas 48 (65%) are working in a Health Professional Shortage Area. Of the 20% of RIDE students working in a CHC, approximately 73% are working/practicing in HPSA (Figure 15). Additionally, on average, 40% of RIDE graduates report treating Medicaid patients in their practice (Table 4).

Figure 16 shows that in 2014 when looking at all cohort data that is available, 39% were identified to be working in rural or underserved region, whereas in 2021, 78% were noted to be practicing in a rural or underserved region. This data shows a significant upwards trend in RIDE graduates pursuing opportunities and practices in rural or underserved regions over the 10 years (Table 5 and Figure 16).

Descriptive findings – Trends (In-state vs. Out-of-state, Practicing in Eastern WA, Practicing in a WWAMI region, and Practicing in Rural & Underserved Area)

Table 6 illustrates the most recent update from October 2022 (excluding Class of 2022) and signifies key findings in our descriptive study. Currently, seventy-six (95%) of the RIDE graduates are actively practicing. Sixty-two (82%) are practicing in rural/underserved communities, 47 (62%) are in rural/underserved practice in Washington state, whereas 53 (70%) are practicing in rural communities in WWAMI designated regions. Fifty-nine (78%) are practicing in the state of Washington and 36 (47%) are practicing in Eastern Washington.

Trends in the first ten years of the RIDE program graduate practice are highlighted in Figure 17. This figure shows that when broken down by cohort, a majority or at least half (4 or more) of these individuals from each class remain in Eastern Washington and practice in a WWAMI region and rural/underserved areas. These results are consistent with our previous findings seen in Table 6, in that when selecting students from in-state, majority (78%) will stay and practice in the state of Washington, pursuing career opportunities in Eastern Washington (47%), a WWAMI region (70%), rural and underserved areas/communities nationwide (82%) and rural/underserved practice in the state of Washington (62%), which is the primary objective of the RIDE program, to increase the number of dentists who practice in rural/underserved communities, in hopes of bridging the gap in oral healthcare disparities.

Statistical Analysis – Effect of rural upbringing (RIDE Provenance & Parental home ZIP code) and working in rural/underserved area post-graduation (current practice location/ZIP code)

The Fisher exact test was utilized for the statistical analysis, which is similar to the Chi square method, but it accounts for the smaller sample size. In this study, (Figure 18, 20 & Table 7) we compared the association between the home RIDE Provenance and location of current practice RUCA code. The P value for this example is less than 0.001, indicating significant association. To adjust for multiple testing, the False Discovery Rate (FDR) correction was applied, so this Q-value represents the adjusted P-value, but it still remains less than 0.001. To account for association impact, Cramer's V statistic was used to determine the effect of this association. The Cramer's V effect ranges from a scale from 0 to 1, however, it is scaled based on the degrees of freedom, which in the current study is 4. Accounting for a degrees freedom of 4, the effect size for a negligible effect is between 0 and 0.05 for a small effect it is between 0.05 and 0.15, for a medium effect it is between 0.15 and less than 0.25, and finally a large effect is anything greater than 0.25. The figure here depicts that we had an effect of 0.431, which is large. When testing this association between rural uprbinging, and after-graduation, a significant association with a large effect size was noted ($p<0.001$, $q<0.001$, Cramer's $V=0.431$). Similar findings were noted in (Figure 20, 22 & Table 7) where RUCA score for home ZIP code was used instead ($p<0.001$, $q<0.001$, Cramer's $V=0.418$). A slightly smaller effect size was noted,

although results could be ambiguous given that for 19 (24%) individuals no parental home zip code was provided during data collection.

Statistical Analysis – Effect of Rural Underserved Opportunities Program (RUOP) site training and Service-Learning Rotation (SLR) and working in rural/underserved area post-graduation

As shown in Figure 22 and Table 8, where the RIDE participants completed their training had a significant impact on their post-graduation practice location and a medium to large effect of (0.246 → 0.25). As seen in Figure 1, all RIDE training sites are considered dental HPSA areas, even though some are in a 'Metropolitan' area, for instance Spokane, WA. When testing this association between RIDE students' training sites and its impact on practice location, once again significant association with a medium to large effect size was noted ($p=0.026$, $q=0.026$, Cramer's $V=0.246$). Similar findings were noted in the bottom portion of Table 8 where RIDE students' Service-Learning Rotation (SLR) was used instead of their RUOP site training ($p=0.022$, $q=0.022$, Cramer's $V=0.261$), with a slightly larger effect size.

V. DISCUSSION

Previous research and literature highlight the severe rural health workforce shortage in both medical and dental professions. Some of the proposed solutions in helping address this disparity, particularly in oral health, include preventative public health initiatives, mobile clinic services, financial incentives for health professionals (scholarships and loan repayment options), as well as academic program initiatives that includes rural community-based clinic experiences. Numerous earlier studies describe rural career incentivization strategies in medical and dental profession within the University of Washington and abroad. Also, recruiting newly graduated dentists to rural regions can be challenging, partly due to lack of awareness and training in providing care to these populations. Access to oral healthcare is a multifactorial and significant concern in most rural communities, particularly with recruitment and retention of dental health professionals. To help attract newly graduate dentists to rural and underserved regions, a well-coordinated and financially supported outreach programs, such as Rural Clinical Placement Program (RCPP) and Community Based Dental Education (CBDE) are essential to implement.

Existing research illustrates the significance of implementing community-based teaching into current dental education models, as it assists newly trained dental students in getting to work in rural and underserved regions in their designated states. Various universities, such as Virginial Commonwealth University, University of Minnesota, Eastern Carolina University, University of Colorado, University of Michigan, and University of Washington, all incorporate CBDE into the 4-year dental school curriculum. For example, the East Carolina University School of Dentistry implements the CBDE model of teaching help increase the number of dentists practicing in rural and underserved regions of North Carolina, by ensuring that all students participate in 2-month long Community Service-Learning Centers (CSLC) during the final year of their education.[22] The CSLS are ECU School of Dentistry clinic sites, the majority of which are in counties designated as a dental Health Professional Shortage Area (HPSA) region.[22] Most of the training sites are considered HPSA sites, which is very similar to the University of Washington Regional Initiative of Dental Education (RIDE) Program (Figure 1).

RIDE's distance learning and education model provides education and clinical opportunities to both dental students and also community dentists in helping deliver quality dental care to rural and/or underserved communities across the state of Washington. Previous studies have reported that a significant limitation in CBDE training in their prospective universities is that most students rotate only during their senior year, at which time most have already made significant career decisions and are in process of applying for residency training.[17] However, as part of the RIDE program educational model, the summer after the first year, the students spend approximately 1-month rotating at an affiliated community health center in Central or Eastern Washington. RIDE has also paved the way for additional developments at various locations and nearby states, one being in Montana. Currently, RIDE is working with the state of Montana to implement a sustainable dental education model in that state, in hopes of addressing the rural Montana's dental workforce needs, given than 79% of Montana's counties are designated as dental health professional shortage areas.[33] Additionally, in 2017, the Montana Department of Labor identified eleven counties without any residing licenses dental provider, with 54% of dentists in the state of Montana living in the six most populated counties.[33]

This study assesses outcomes of the first 10 years of the RIDE program. The primary hypothesis tested is that rural background is the most important predictor of long-term rural dental practice. Additionally, the second hypothesis tested was whether the site where the RIDE

students received their training (RUOP and SLR training sites/opportunities) has a significant impact on choices to pursue career opportunities in rural and underserved regions in Washington and WWAMI region. The preliminary findings in the study show a statistical significance regarding RIDE students' rural upbringing, as well as the training sites and opportunities provided to them during their time in dental school, having a major impact on their decision to pursue career opportunities in rural and underserved regions. Students' RIDE Provenance, as well as Parental home ZIP codes were both utilized in attempting to analyze the relationship between the students' rural upbringings and their likelihood of choosing to practice in a rural and underserved area (indicated by HPSA site, CHC and/or RUCA score). It is significant to highlight that although majority (n=57) of home RIDE provenances are in a Metropolitan area and most (n=60) are practicing in a metropolitan area, based on their current practice information, these numbers are misrepresentative in that majority of these individuals are practicing in a HPSA or rural/underserved clinic within a metropolitan area, as shown in Figure 1. Similar significant findings ($p<0.001$) and medium to large effect sizes were noted when determining the association of RUOP and SLR sites and working in rural and/or underserved regions post-graduation.

These findings are consistent with previous research in that providing students with various outreach, rural, and community-based dental opportunities during dental school, is effective in recruiting these professionals to rural regions in their prospective states and helping bridge the gap in oral healthcare disparities. Previous investigation by Mays et al. reported that although students' intent to practice in a rural region was not significantly altered by a clinical rotation, students from rural regions prior to attending college had strong intentions to seek careers in a rural and underserved communities.[17] Unlike the Mays et al. report, our study showed strong associations with *both* students' rural upbringing and clinical training sites.

Our non-statistical analysis was conducted to assess demographic information such as rural trends by sex, ethnicity, residency training, CHC/HPSA distribution, location of high school and remaining in Washington state, as well as trends in rural practice over time. Although a majority (n=50, 63%) of the RIDE participants were male, those practicing in rural and underserved regions, including Health Professional Shortage Areas (HPSA) sites and Community Health Clinics (CHC) was very evenly distributed between male and female dentists, as depicted in Figures 6 and 7. The majority of the RIDE participants during this study

period between the ages of 25-29, which could imply that younger graduates may be more willing to relocate to rural and underserved regions across the state, as opposed to those with already establish families and/or commitments. Approximately 32.5% of RIDE graduates pursued post-graduate specialty training, with majority (n=6, 75%) of Class of 2021 (Cohort 10), most recent graduating class (excluding Class of 2022), pursuing residency education as opposed to immediately practicing. This is an interesting finding, which could have been correlated to the coronavirus (COVID-19) pandemic impeding recent dental school graduates from pursuing career opportunities and from receiving robust clinical training during the years of the pandemic. Significant concerns were raised at the time of the pandemic, beginning March 11th, 2020, concerning interruptions in the educational/clinical opportunities for soon-to-be graduates, inability to complete licensure examinations and concerns for long-term stability for the dental profession overall.[37] Provided that many dental schools across the U.S. were forced to close temporarily as a result of the pandemic, many graduates did not feel competent in their skills and wished to pursue further residency training. This could leave a lasting impact for future years as well, so for future studies, it would be interesting to assess the outcomes pertaining to residency training, following the pandemic.

When looking at location of high school (state) and likelihood of staying in Washington, 87% of students that went to high school in WA, ended up practicing in a WWAMI region. We also assessed individual's home location (HS state) and current practice location, showing overwhelming majority staying and practicing in their home region (Figure 13). Another interesting finding was that even though the majority of subjects (n=59, 80%) are not working in a CHC, of the 20% working in a CHC, approximately 73% are working/practicing in HPSA as shown in Figure 15. For the purposes of our study, if an individual was working in a CHC, HPSA site, and/or RUCA score of 7-10, this was considered a rural and/or underserved area. Figure 16 shows a substantial upwards trend in RIDE graduates pursuing practice opportunities in rural regions over a 10-year period. Regarding the most recent data (Table 6), it is notable that the majority (82%), of subjects are practicing in rural and/or underserved communities, (n=53, 70%) are in rural communities in a WWAMI designated regions and nearly half (47%) are practicing in Eastern Washington. These findings are consistent with the primary mission of the RIDE program in aiming to increase the number of individuals who practice in rural/underserved communities in Washington.

Although our descriptive study presents multiple beneficial findings, there are several limitations that should be discussed. For purposes of this study, small towns and rural/ isolated are grouped separately and rural is defined as (RUCA code 10) population below 2,500 (Appendix II). Figure 2 map information was used to identify rural and urban counties within the state of Washington. Additionally, according to the 2016 Washington States Oral Health Workforce Report (Figure 24), 5% of dentists in Washington state practice in a rural area, while 8.4% of the population resides in a rural area[38]. This data has been captured cross sectionally over a decade and does not adjust for changes in the size of these towns, which could affect some of our findings. Certainly, the size of the populations over a span of 10 years could have significantly changed the RUCA designations for some of these communities/regions, therefore, to account and address for this, we need to apply stepwise logistic regression modeling. Additional limitation was the small sample size (n=80) with each cohort comprising of approximately eight participants. Given that the University of Washington's SoD entering class size is about 63 students, the RIDE program participants comprise only roughly 12% of the total dental school class size. Finally, some of the data was self-reported and for the purposes of our study, there were missing data/information which impacted the overall findings.

Future research recommendations include assessing RIDE graduates compared to non-RIDE dental school graduates in examining trends and significant associations regarding pursuing career opportunities and practices in rural and/or underserved communities. Additional analysis of parental occupations and correlation to rural practice for all RIDE graduates would be further illuminating. Lastly, given the extensive available dataset, it would be an area of future study to assess study variables with rural retention.

VI. CONCLUSIONS

Based on the study's results, the following conclusions can be made:

1. Graduates of the RIDE program practice in rural areas in greater proportion compared to the general population of practicing dentists.
2. Statistical analysis demonstrated strong association when analyzing the relationship between University of Washington School of Dentistry RIDE

students rural upbringing and choosing to practice in rural and/or underserved region post-graduation.

3. Statistical analysis demonstrated strong association when analyzing the relationship between University of Washington School of Dentistry RIDE students Rural Underserved Opportunities Program (RUOP) training site and Service-Learning Rotation (SLR) and choosing to practice in rural and/or underserved region post-graduation.
4. RIDE graduates from the study period tended to be male, Caucasian, and practice dentistry in a Health Professional Shortage Area (HPSA) or rural site/clinic.

VII. TABLES & FIGURES

Table 1. Demographics data for University of Washington School of Dentistry RIDE Participants from (2012 – 2021)

	2012 Cohort 1	2013 Cohort 2	2014 Cohort 3	2015 Cohort 4	2016 Cohort 5	2017 Cohort 6	2018 Cohort 7	2019 Cohort 8	2020 Cohort 9	2021 Cohort 10	Total	
	N	N	N	N	N	N	N	N	N	N	N	%
Interviews & Graduates												
Total graduates	7	8	8	8	8	9	8	8	8	8	80	100%
Sex												
Male	5	3	7	4	7	5	5	4	5	5	50	63%
Female	2	5	1	4	1	4	3	4	3	3	30	38%
Age Group												
25-29	2	4	6	4	6	7	8	6	6	5	54	68%
30-35	5	4	2	3	2	2	0	2	1	2	23	29%
36-39	0	0	0	0	0	0	0	0	1	1	2	3%
>40	0	0	0	1	0	0	0	0	0	0	1	1%
State Practicing/Residency												
WA Only	6	5	6	6	6	7	6	6	5	5	58	73%
WAMI	0	2	0	0	0	1	1	1	1	0	6	8%
OOS	1	1	2	2	1	1	1	1	2	3	15	19%
N/A	0	0	0	0	1	0	0	0	0	0	1	1%
County Practicing												
East	1	0	1	3	0	0	3	1	2	0	11	14%
South Central	1	0	0	0	3	1	2	0	1	1	9	11%
North Central	2	1	2	1	0	1	0	1	1	3	12	15%
North West	1	2	1	0	0	0	0	0	0	0	4	5%
South West	0	0	0	1	0	1	0	0	0	0	2	3%
West	0	0	0	0	0	0	0	0	1	0	1	1%
North	0	0	0	0	0	0	0	1	0	0	1	1%
Puget Sound	1	2	2	1	3	2	1	3	0	2	17	21%
OOS	1	3	2	1	1	1	1	2	2	2	16	20%
N/A	0	0	0	1	1	3	1	0	1	0	7	9%
Rural Upbringing												
Yes	4	3	1	2	3	3	2	3	2	4	27	34%
No	3	2	2	2	4	4	2	4	4	1	28	35%
OOS	0	1	1	1	1	2	1	0	2	1	10	13%
N/A	0	2	4	3	0	0	3	1	0	2	15	19%
Specialty Training												
Yes	2	4	4	1	2	2	3	2	0	6	26	33%
No	5	4	4	7	6	7	5	6	8	2	54	68%

Note: Under the category 'State practicing/residency' WWAMI is split into WA only and WAMI, which includes (Wyoming, Alaska, Montana, and Idaho). Counties were divided by regions for ease of presentation and data analysis using Washington Office of Governor (Figure 4). Out of state is abbreviated as, OOS.

Table 2. Rural Urban Commuting Area (RUCA) codes divided by Practice Location, Parental/home ZIP code and RIDE Provenance

	2012 Cohort 1	2013 Cohort 2	2014 Cohort 3	2015 Cohort 4	2016 Cohort 5	2017 Cohort 6	2018 Cohort 7	2019 Cohort 8	2020 Cohort 9	2021 Cohort 10	Total	
	N	N	N	N	N	N	N	N	N	N	N	%
RUCA - Practice Location												
1-3	5	5	6	5	7	6	7	4	5	5	55	69%
4-6	1	1	1	2	0	0	0	2	2	1	10	13%
7-9	0	1	0	1	0	0	0	1	0	1	4	5%
10	1	1	0	0	0	0	1	0	1	1	5	6%
N/A	0	0	1	0	1	3	0	1	0	0	6	8%
RUCA - Home Zip												
1-3	5	3	4	4	5	7	3	5	4	5	45	56%
4-6	2	2	0	0	2	1	0	0	0	0	7	9%
7-9	0	1	0	1	1	0	2	1	0	1	7	9%
10	0	0	0	0	0	0	0	1	1	0	2	3%
N/A	0	2	4	3	0	1	3	1	3	2	19	24%
RUCA - RIDE Provenance												
1-3	5	5	6	7	5	8	5	6	4	6	57	71%
4-6	2	1	2	0	2	1	1	0	2	0	11	14%
7-9	0	1	0	1	1	0	2	2	1	1	9	11%
10	0	1	0	0	0	0	0	0	1	1	3	4%
N/A	0	0	0	0	0	0	0	0	0	0	0	0%

Note: Rural Urban Commuting Area (RUCA) codes are a census, tract-based classification, which uses census measures of population density, urbanization, and daily commuting to characterize all U.S. census tracts respective to their rural/urban status. In this study, ZIP codes census database was used to assign a RUCA code score. In the RUCA classification system, each ZIP code is assigned to a primary code between 1 and 10, depending on its characteristics such as Metropolitan/Urban (50,000 or more), Micropolitan/Large Town (10,000 - 49,999), Small town (2,500 - 9,999), or Rural/Isolated (under 2,500). Higher RUCA score/number is indicative of more rurality. RUCA scores were compiled by using 'USDA Economic Research Service U.S. Department of Agriculture' zip-code file (last update in 8/17/2020).

Table 3. Additional variables of interest (I) including – Ethnicity, Parental Occupation, High School location and Leadership roles

	2012 Cohort 1	2013 Cohort 2	2014 Cohort 3	2015 Cohort 4	2016 Cohort 5	2017 Cohort 6	2018 Cohort 7	2019 Cohort 8	2020 Cohort 9	2021 Cohort 10	Total	
	N	N	N	N	N	N	N	N	N	N	N	%
Ethnicity												
AFR-AM	0	0	0	1	0	0	0	0	0	0	1	1%
AMR-IND	0	0	0	0	1	0	0	0	0	0	1	1%
Asian	1	1	0	1	0	2	0	1	0	2	8	10%
Caucasian	6	7	8	6	4	5	7	5	7	2	57	71%
Hispanic	0	0	0	0	3	2	1	2	1	4	13	16%
Parent Occupation												
Manager	4	4	0	1	2	1	1	2	1	0	16	10%
Professionals	1	4	8	4	2	3	5	2	4	2	35	22%
Technicians and Associate Professionals	3	0	2	2	1	0	0	3	0	0	11	7%
Clerical Support Workers	2	1	2	1	2	1	0	2	0	0	11	7%
Services and Sales Workers	0	0	0	0	1	1	5	1	2	2	12	8%
Craft and Related Trades Workers	0	0	0	1	0	1	1	0	1	1	5	3%
Plant and Machine Operators and Assemblers	0	0	0	0	1	0	0	1	0	0	2	1%
Elementary Occupations	1	0	0	0	1	2	1	0	2	5	12	8%
Not Seeking Employment	2	5	2	4	0	5	0	1	2	3	24	15%
Unemployed	0	0	0	1	2	0	2	0	0	0	5	3%
N/A	1	2	2	2	4	4	1	4	4	3	27	17%
Location of High School												
WA Only	7	8	7	6	7	7	7	6	6	7	68	85%
WAMI	0	0	0	1	0	1	1	1	1	0	5	6%
OOS	0	0	1	0	1	1	0	1	1	1	6	8%
OOC/Foreign	0	0	0	1	0	0	0	0	0	0	1	1%
Self-Reported Leadership (Y/N)												
Y	2	4	5	3	0	1	3	1	1	0	20	31%
N	2	1	2	3	7	4	4	6	7	8	44	69%
N/A	3	3	1	2	1	4	1	1	0	0	16	25%

Note: Abbreviations – African America (AFR-AM), American Indian (AMR-IND).

Table 4. Additional variables of interest (II) including - Community Health Center (CHC), Health Professional Shortage Area (HPSA) and Self-reported Medicaid

	2012 Cohort 1	2013 Cohort 2	2014 Cohort 3	2015 Cohort 4	2016 Cohort 5	2017 Cohort 6	2018 Cohort 7	2019 Cohort 8	2020 Cohort 9	2021 Cohort 10	Total	
	N	N	N	N	N	N	N	N	N	N	N	%
CHC												
Yes	1	0	1	1	2	1	1	3	2	3	15	19%
No	6	8	6	7	5	4	7	5	6	5	59	74%
N/A	0	0	1	0	1	4	0	0	0	0	6	8%
HPSA												
Yes	6	6	3	5	3	4	7	5	6	3	48	60%
No	1	2	4	2	4	2	1	3	2	5	26	33%
N/A	0	0	1	1	1	3	0	0	0	0	6	8%
Self-Reported Medicaid												
Average	11%	27%	46%	39%	59%	34%	20%	61%	37%	61%	40%	

Note: Abbreviations - CHC (Community Health Center) and HPSA (Health Professional Shortage Area).

Table 5. Trends in Rural Practice Over 10-year Timespan, depicted by update year (x-axis) and cohort year (y-axis)

Class Year	2014	2015	2016	2017	2018	2019	2020	2021	Grand Total
2012 - Cohort 1	71%	86%	86%	86%	86%	86%	71%	86%	82%
2013 - Cohort 2	38%	50%	50%	63%	75%	75%	75%	75%	63%
2014 - Cohort 3	13%	63%	75%	88%	63%	63%	38%	88%	61%
2015 - Cohort 4	0%	63%	75%	75%	63%	63%	75%	75%	70%
2016 - Cohort 5	0%	0%	63%	63%	63%	75%	75%	63%	67%
2017 - Cohort 6	0%	0%	0%	33%	56%	67%	78%	89%	64%
2018 - Cohort 7	0%	0%	0%	0%	75%	88%	88%	88%	84%
2019 - Cohort 8	0%	0%	0%	0%	0%	50%	63%	75%	63%
2020 - Cohort 9	0%	0%	0%	0%	0%	0%	63%	75%	69%
2021 - Cohort 10	0%	0%	0%	0%	0%	0%	0%	63%	63%
Grand Total	39%	65%	69%	67%	68%	70%	69%	78%	69%

Table 6. October 2022 Update - Trends (In-state vs. Out-of-state, Practicing in Eastern WA, Practicing in a WWAMI region, and Practicing in Rural & Underserved Area)

Updated October 2022		% of those in practice	% of total
TOTAL (N)	80		
In practice	76	95%	
Eastern WA	36	47%	45%
Rural/underserved communities	62	82%	78%
Prac in WA State	59	78%	74%
Rural/Underserved Prac in WA State	47	62%	59%
Rural/underserved communities in WWAMI Region	53	70%	66%

Table 7. RIDE Provenance / Parental home ZIP code and Current practice RUCA Designation (Statistical Analysis)

		Current Practice RUCA Designation ~ RIDE Cohorts 1-10							
Variable	**N**	**Overall**, N = 80[1]	**Metropolitan**, N = 60[1]	**Micropolitan**, N = 11[1]	**Small_Town**, N = 4[1]	**Rural**, N = 5[1]	**p-value**[2]	**q-value**[3]	**Cramer's V**[4]
RUCA_RP_G	80						<0.001	<0.001	0.431
Metropolitan		57 (71%)	49 (82%)	5 (45%)	1 (25%)	2 (40%)			
Micropolitan		11 (14%)	8 (13%)	3 (27%)	0 (0%)	0 (0%)			
Small_Town		9 (11%)	3 (5.0%)	2 (18%)	3 (75%)	1 (20%)			
Rural		3 (3.8%)	0 (0%)	1 (9.1%)	0 (0%)	2 (40%)			
RUCA_Home_G	80						<0.001	<0.001	0.418
Metropolitan		45 (56%)	37 (62%)	4 (36%)	0 (0%)	4 (80%)			
Micropolitan		7 (8.8%)	4 (6.7%)	2 (18%)	0 (0%)	1 (20%)			
Small_Town		7 (8.8%)	3 (5.0%)	1 (9.1%)	3 (75%)	0 (0%)			
Rural		2 (2.5%)	0 (0%)	1 (9.1%)	1 (25%)	0 (0%)			
N/A		19 (24%)	16 (27%)	3 (27%)	0 (0%)	0 (0%)			

[1] n (%)
[2] Fisher's exact test
[3] False discovery rate correction for multiple testing
[4] Cramer's V Effect Size: DF = 4 | Negligible 0 < 0.05 | Small 0.05 < 0.15 | Medium 0.15 < 0.25 | Large > 0.25

Table 8. RUOP & SLR Training and Current practice RUCA Designation

		Current Practice RUCA Designation ~ RIDE Cohorts 1-10							
Variable	**N**	**Overall**, N = 80[1]	**Metropolitan**, N = 60[1]	**Micropolitan**, N = 11[1]	**Small_Town**, N = 4[1]	**Rural**, N = 5[1]	**p-value**[2]	**q-value**[3]	**Cramer's V**[4]
RUCA_RUOP_G	80						0.026	0.026	0.246
Metropolitan		40 (50%)	35 (58%)	1 (9.1%)	1 (25%)	3 (60%)			
Micropolitan		20 (25%)	11 (18%)	7 (64%)	1 (25%)	1 (20%)			
Small_Town		19 (24%)	13 (22%)	3 (27%)	2 (50%)	1 (20%)			
N/A		1 (1.3%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)			
RUCA_SLR_G	80						0.022	0.026	0.261
Metropolitan		43 (54%)	38 (63%)	2 (18%)	1 (25%)	2 (40%)			
Micropolitan		19 (24%)	12 (20%)	5 (45%)	1 (25%)	1 (20%)			
Small_Town		17 (21%)	10 (17%)	3 (27%)	2 (50%)	2 (40%)			
Rural		1 (1.3%)	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)			

[1] n (%)
[2] Fisher's exact test
[3] False discovery rate correction for multiple testing
[4] Cramer's V Effect Size: DF = 4 | Negligible 0 < 0.05 | Small 0.05 < 0.15 | Medium 0.15 < 0.25 | Large > 0.25

Figure 1. Map of RIDE affiliate sites in WA

RIDE REGIONAL INITIATIVES IN DENTAL EDUCATION SCHOOL OF DENTISTRY

Figure 2. Map of Rural and Urban counties according to Washington State Department of Health[31]

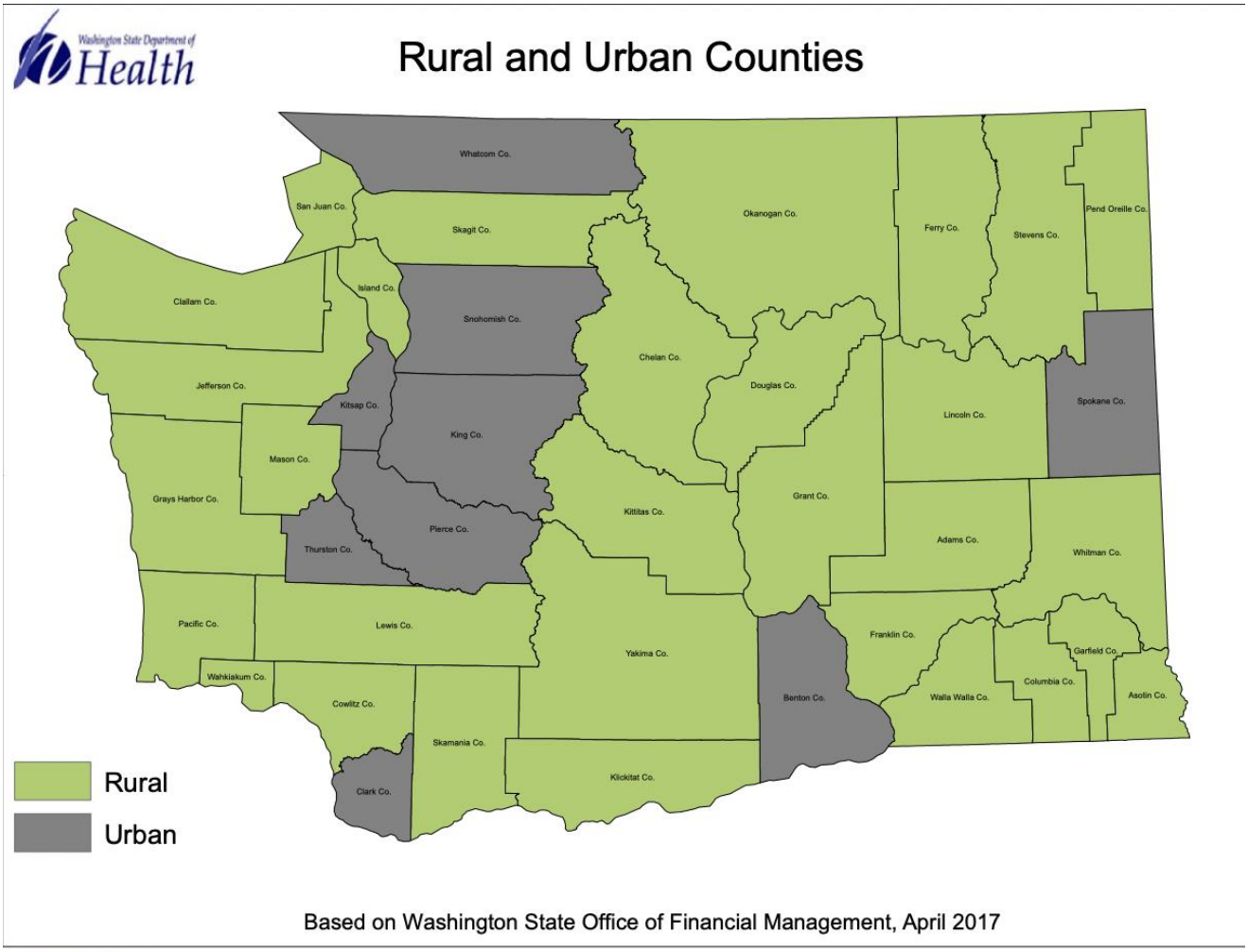
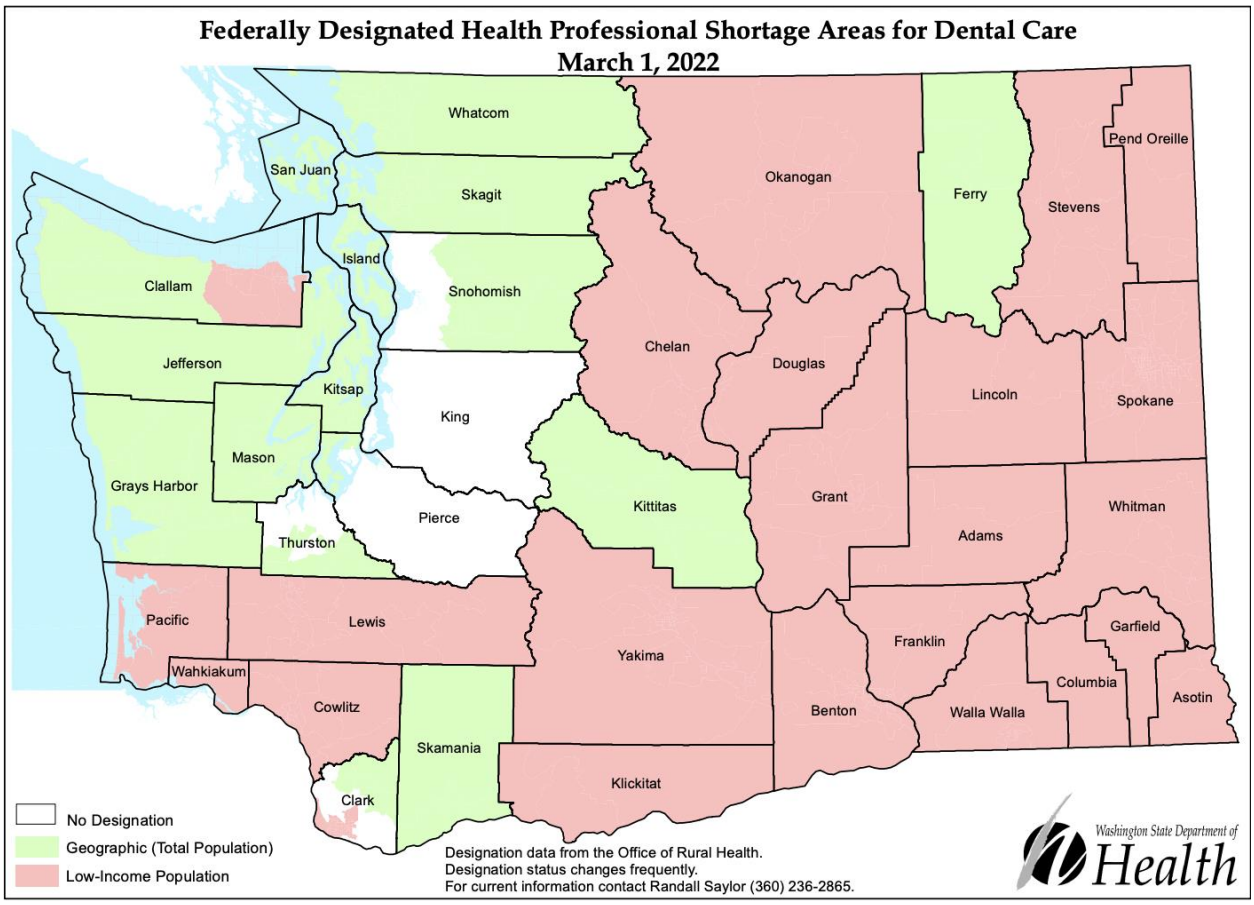
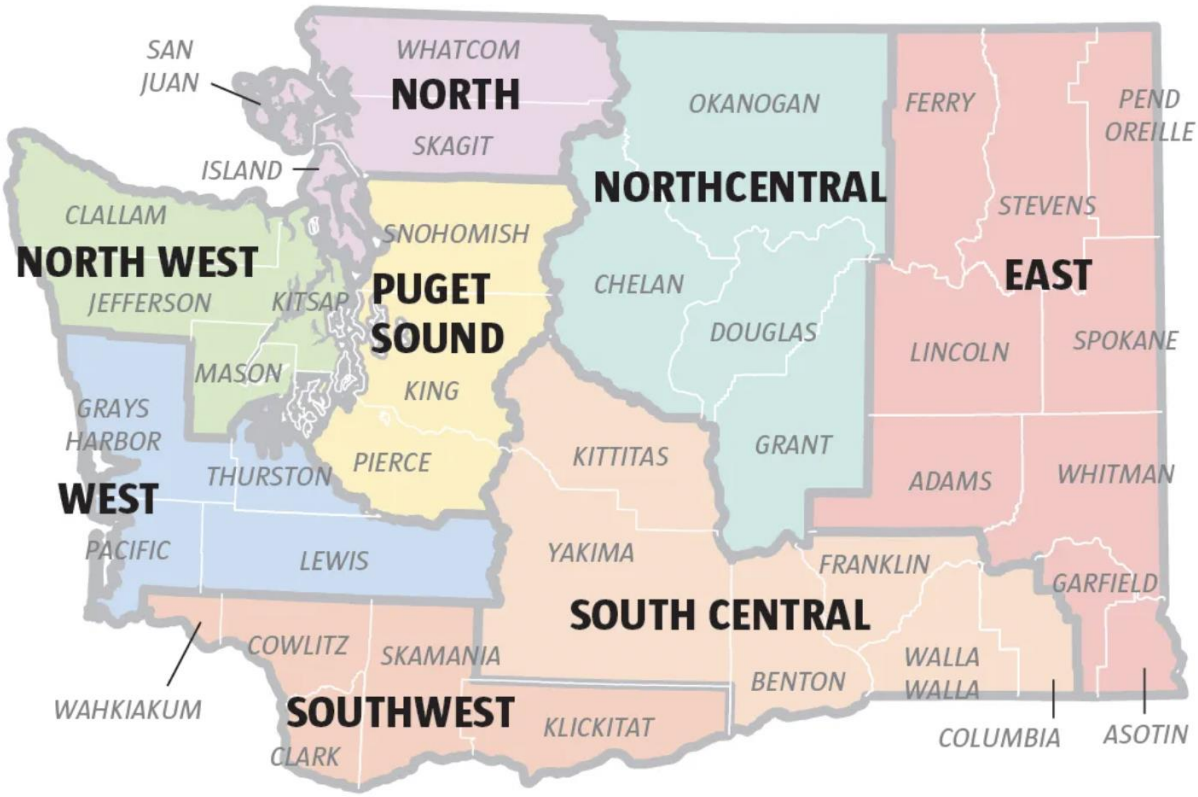


Figure 3. Map of Federally Designated Health Professional Shortage Areas for Dental Care according to Washington State Department of Health



Note: Geographic (Total Population) – A shortage of providers for the entire group of individuals within a defined geographic region.[31] Low-income Population – A shortage of providers for low-income individuals within a defined geographic region.[31]

Figure 4. Washington State County Map by Region



Source: Office of Governor Jay Inslee

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Figure 5. Sex distribution

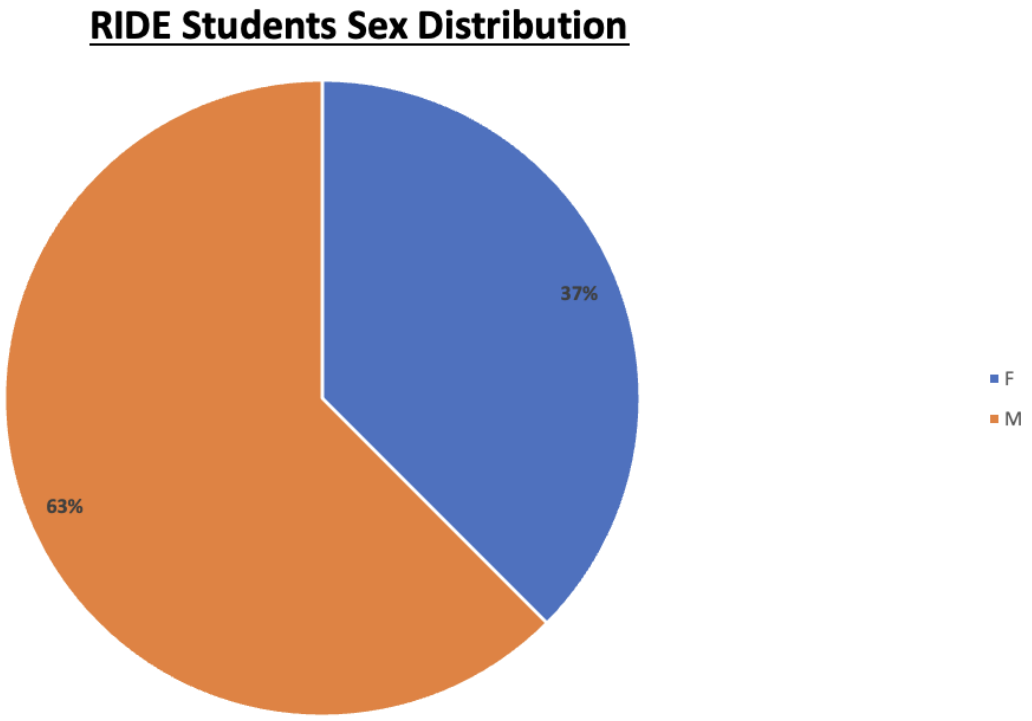


Figure 6. Rural Practice Trends by Sex (Pie Chart)

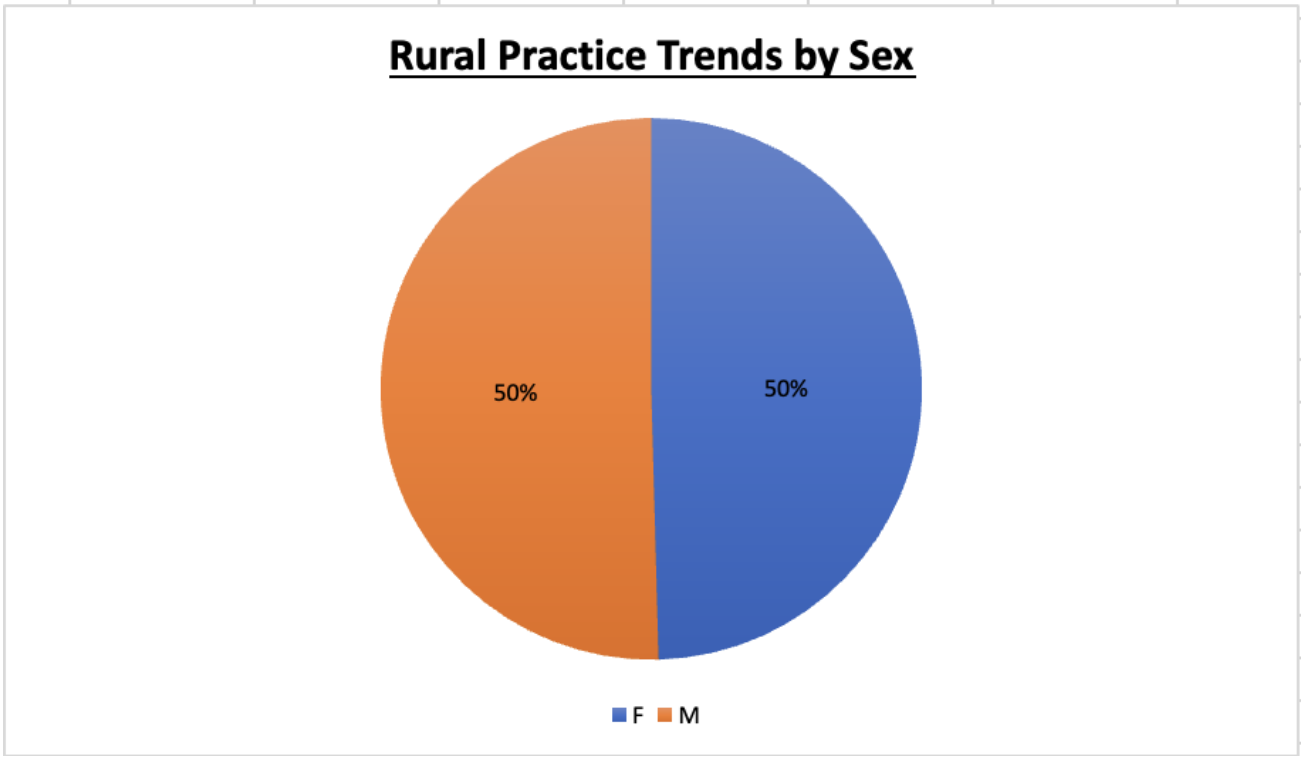


Figure 7. Residency (Specialty) Training %

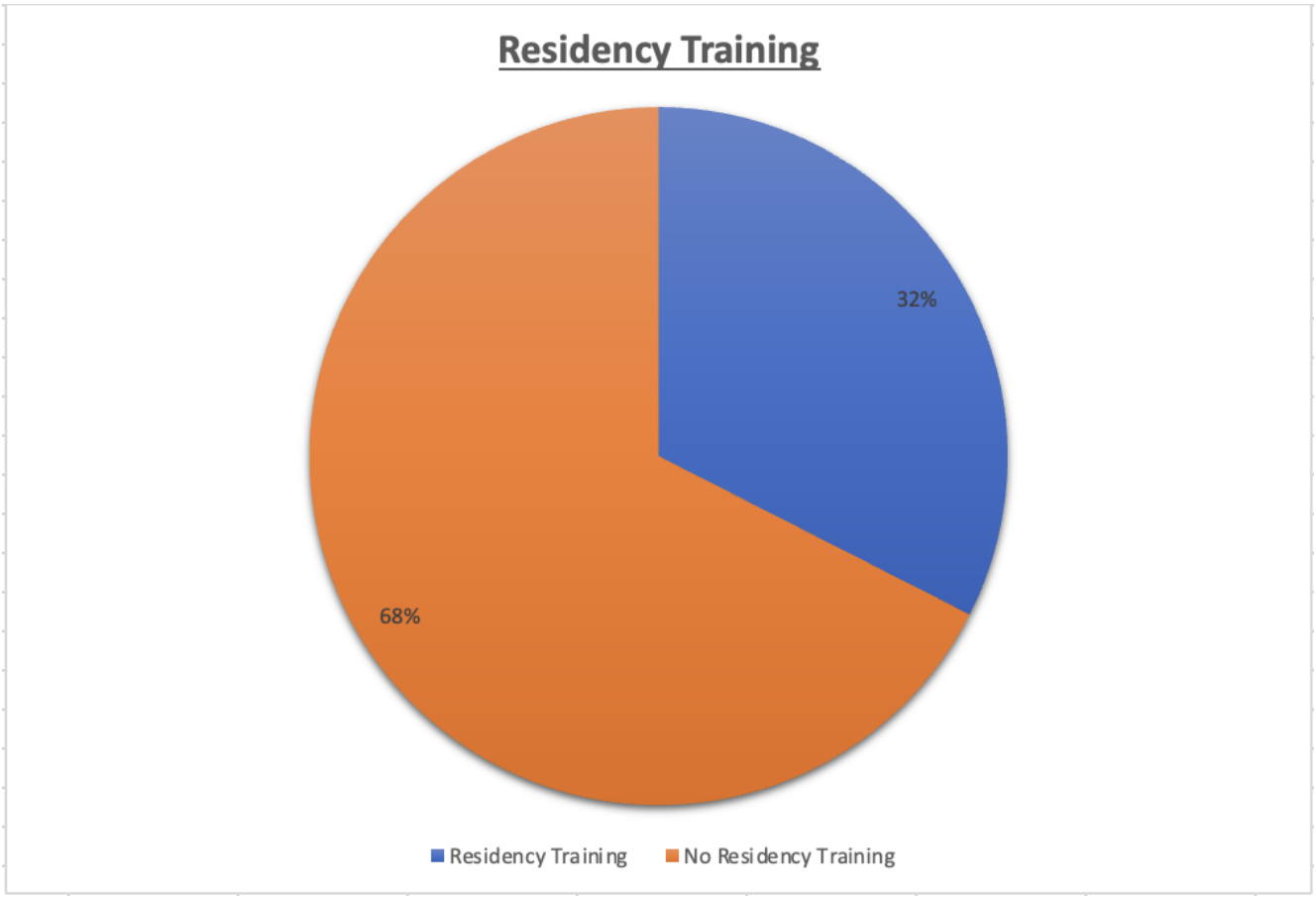


Figure 8. Type of Residency (Specialty) Training % Destitution

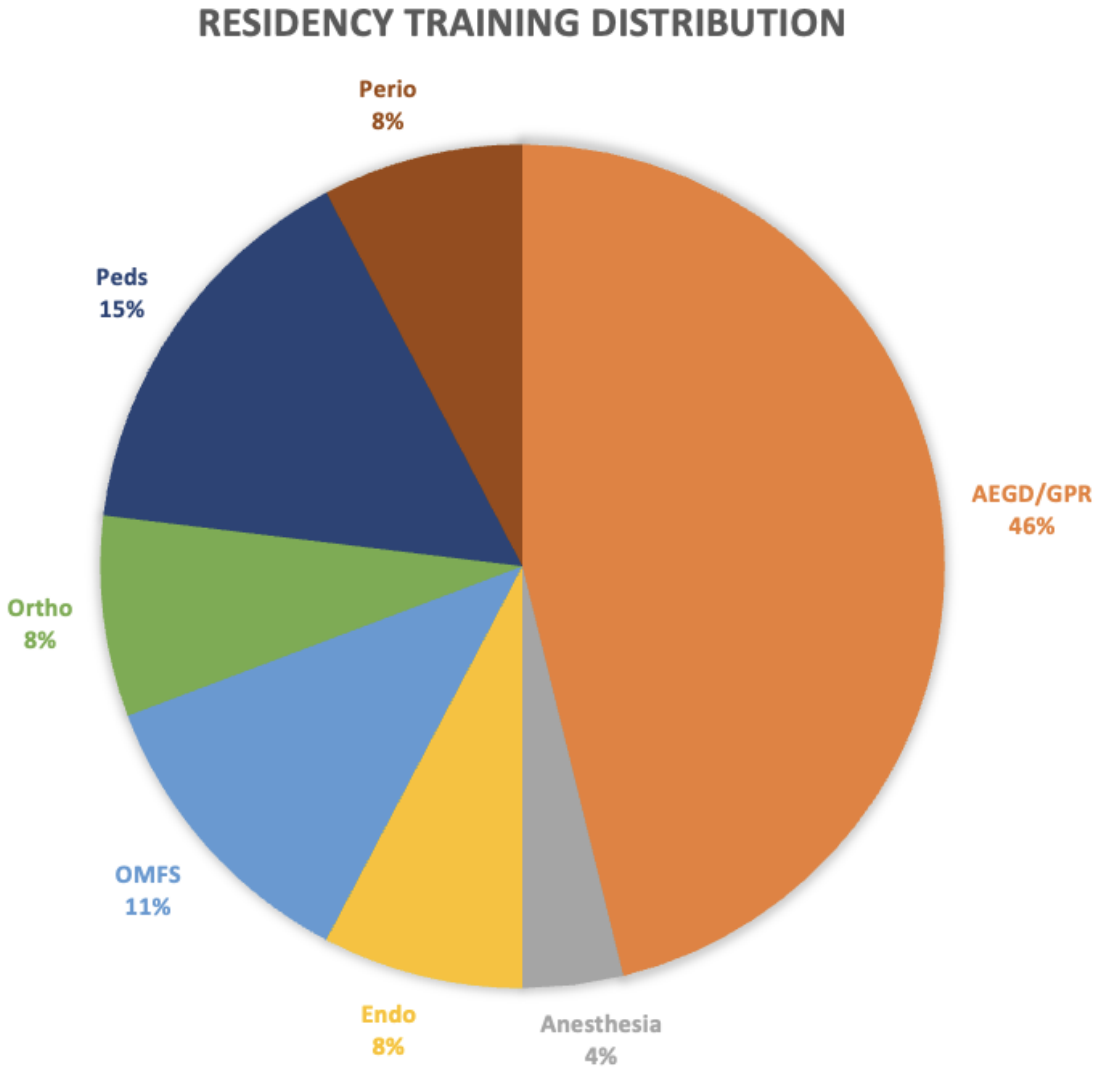


Figure 9. Ethnicity Distribution

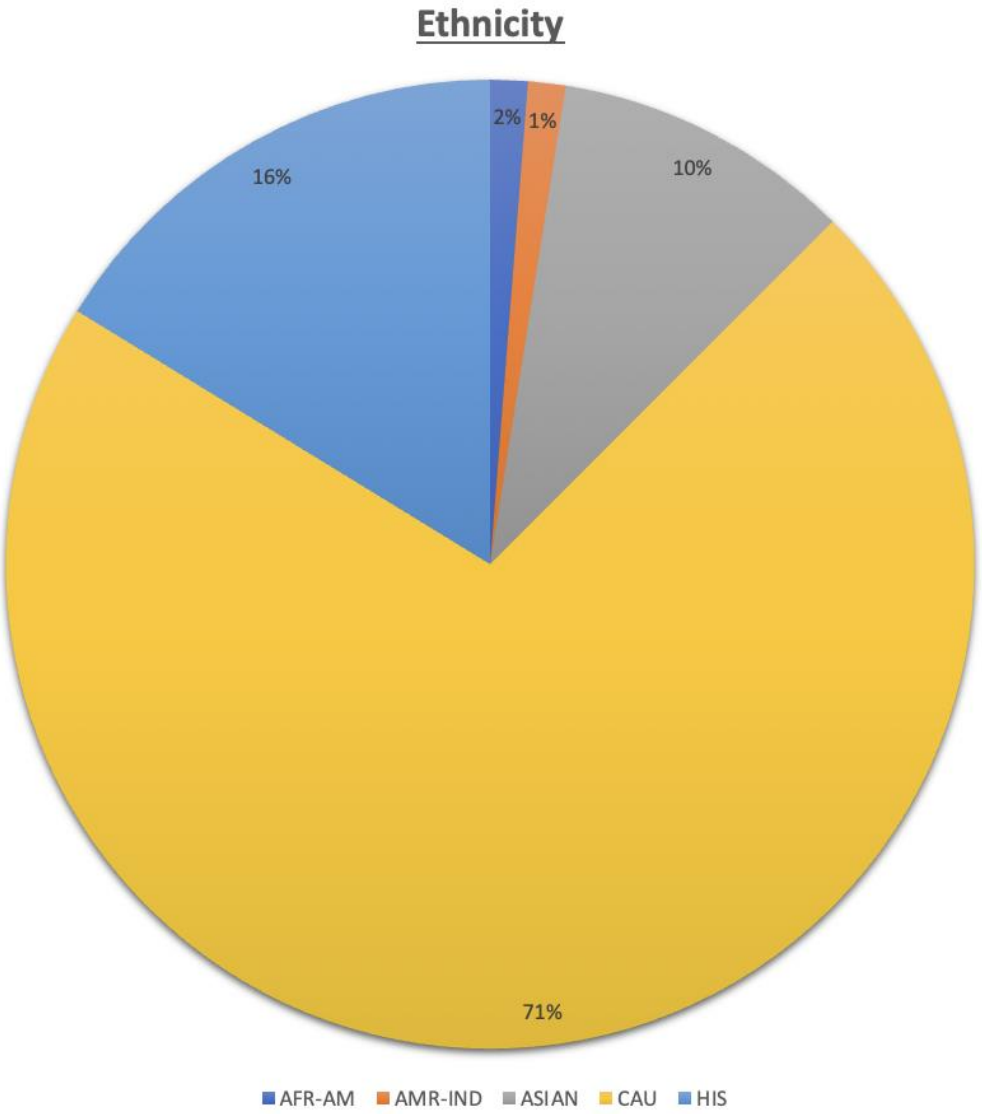


Figure 10. RIDE Students' Parental Occupation

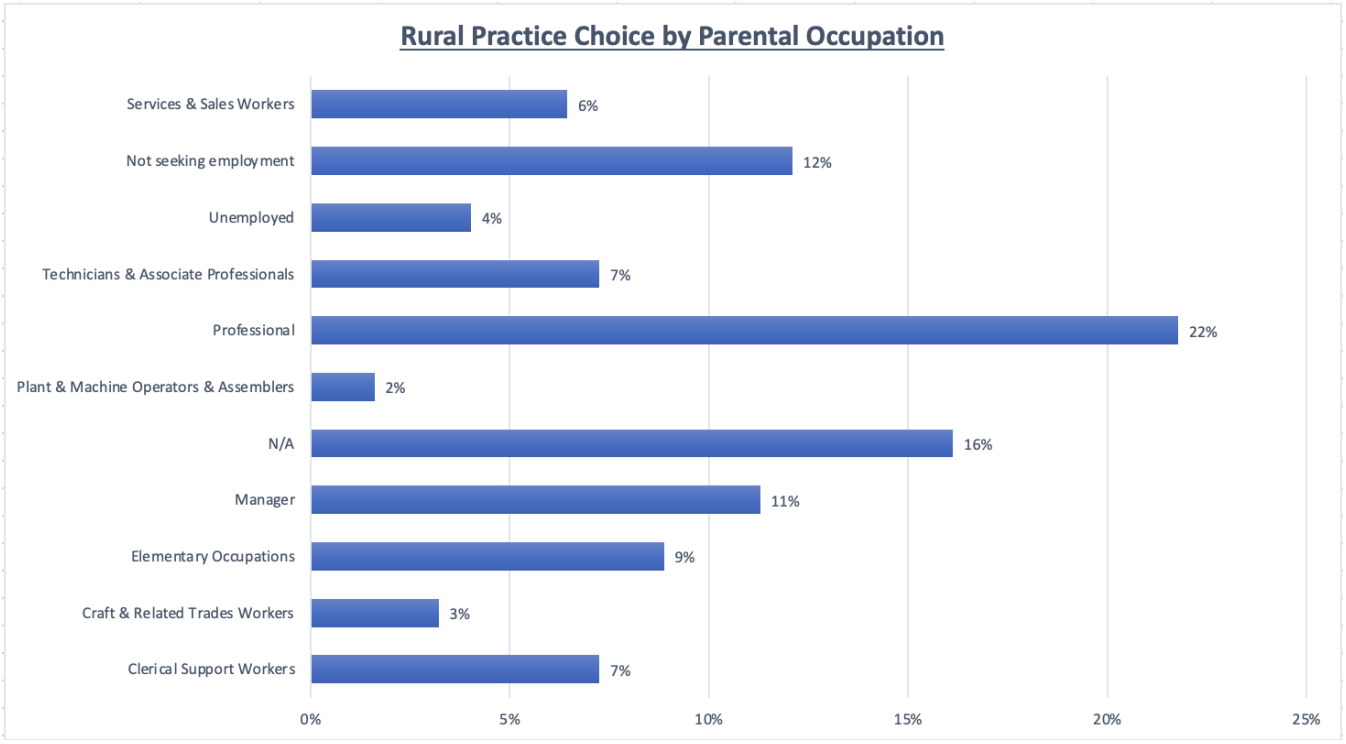


Figure 11. Location of high school (state) and likelihood of staying in WWAMI

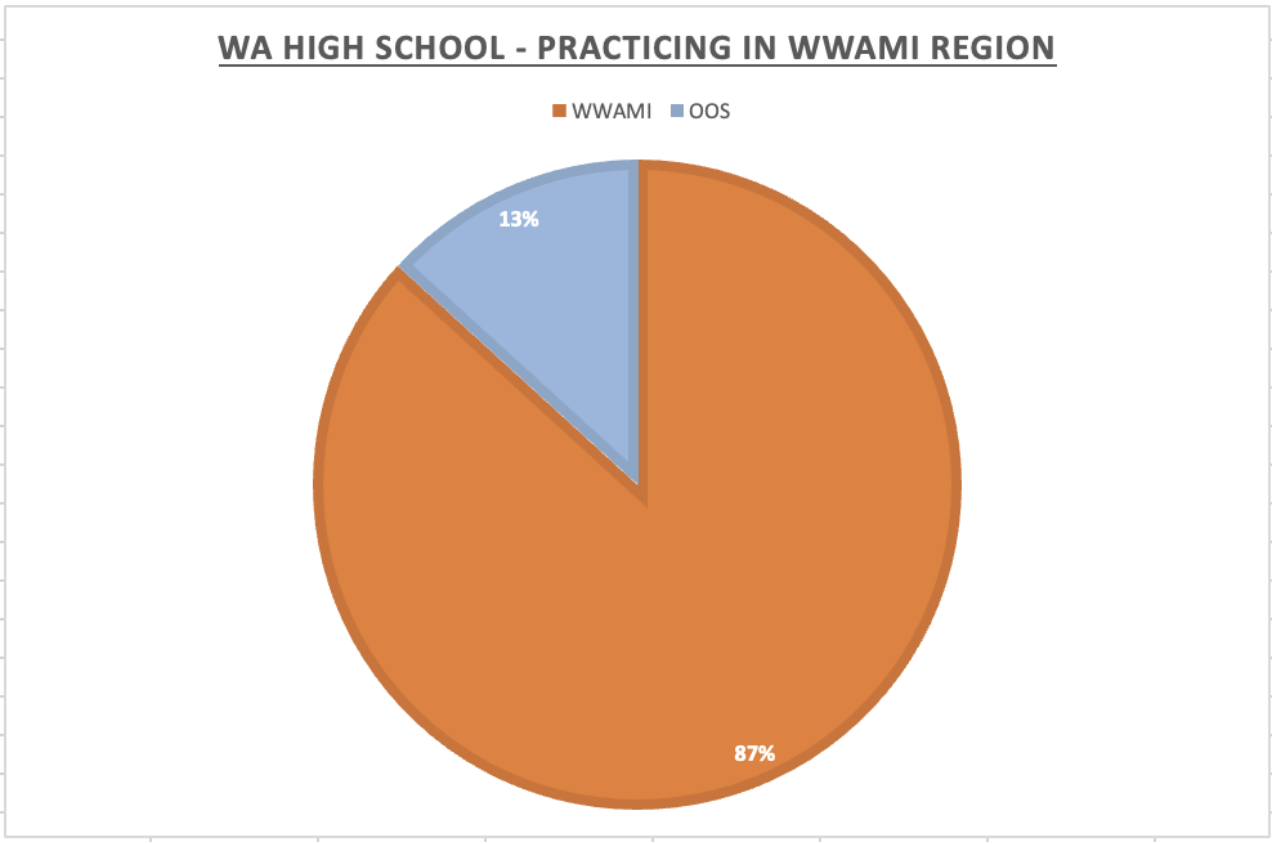


Figure 12. U.S. Distribution by Region

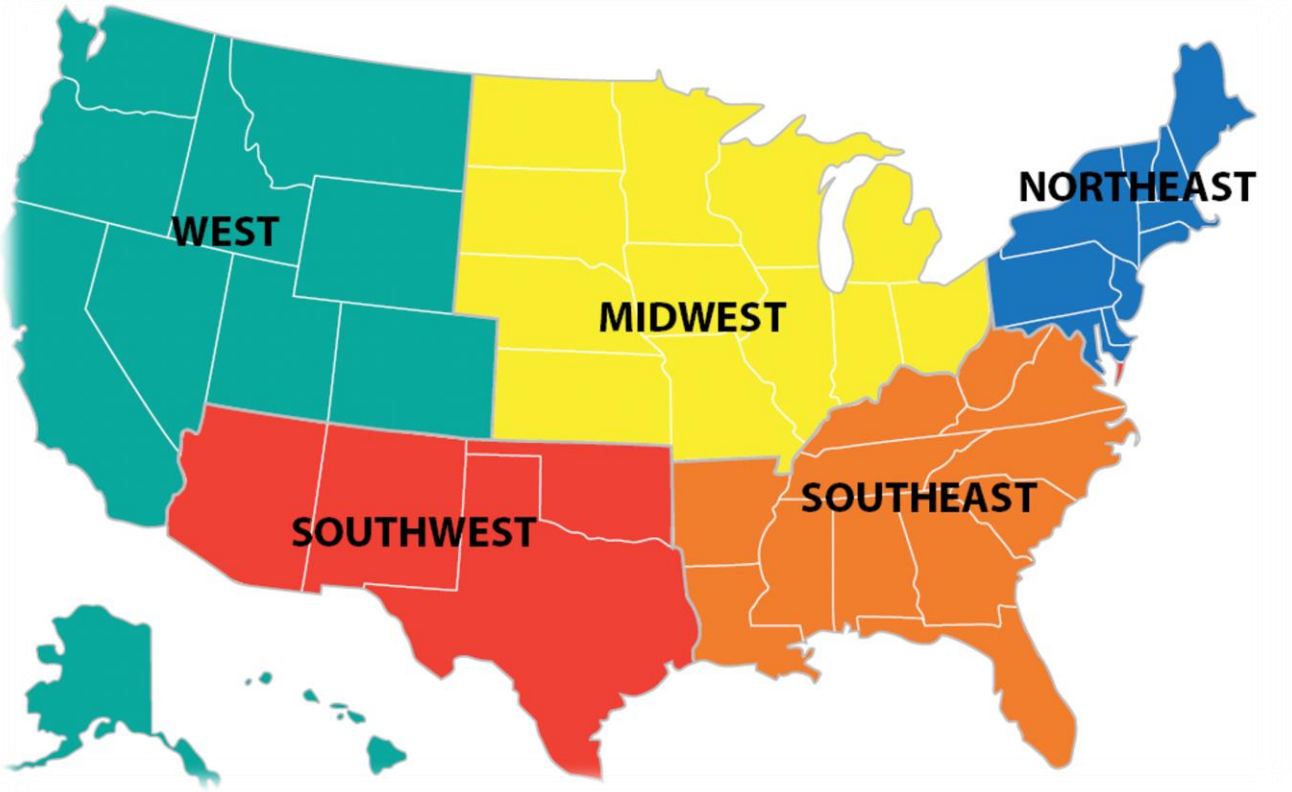


Figure 13. Home Location (HS State) and Practice Location

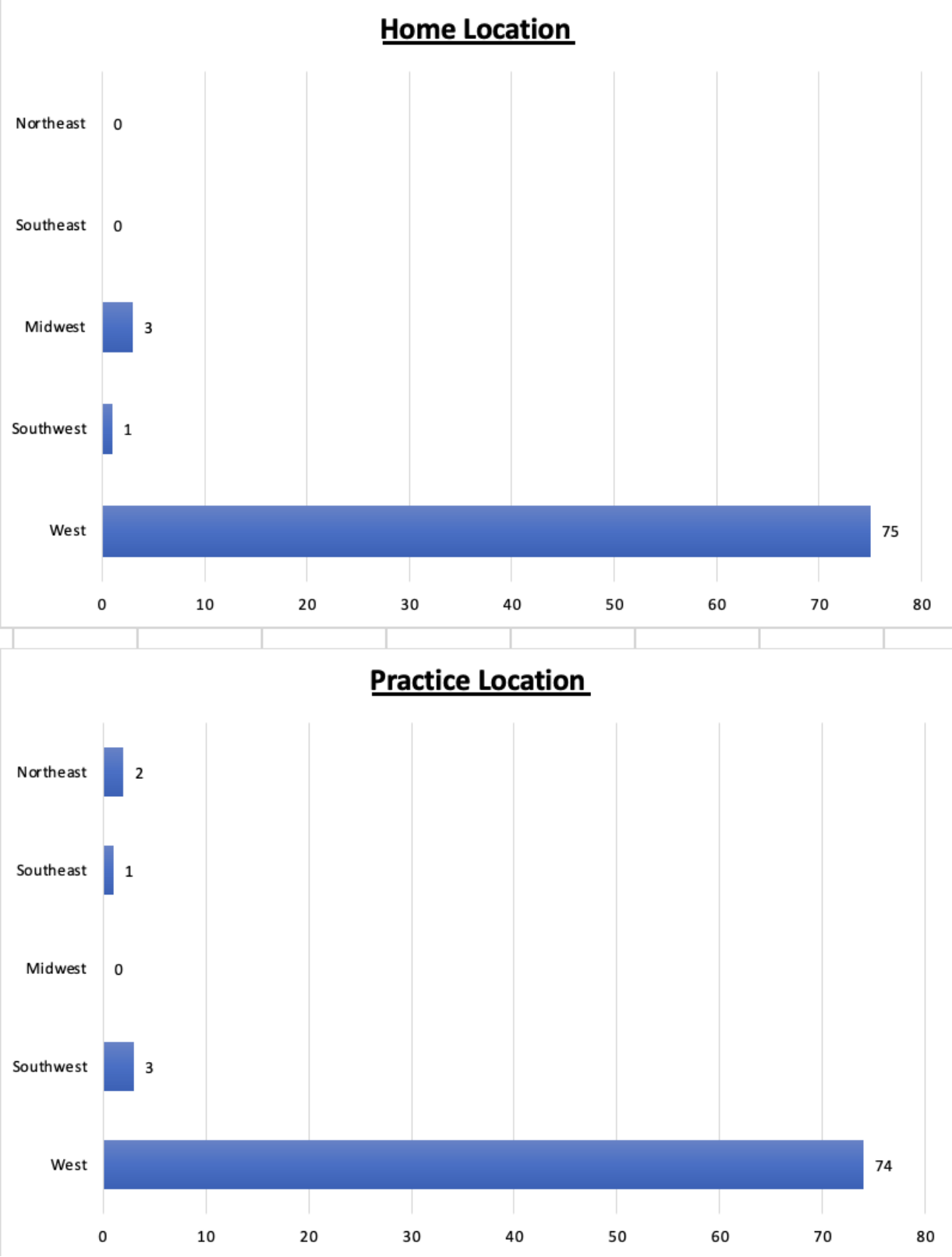


Figure 14. % of Participants Practicing in CHC and/or HPSA Sites

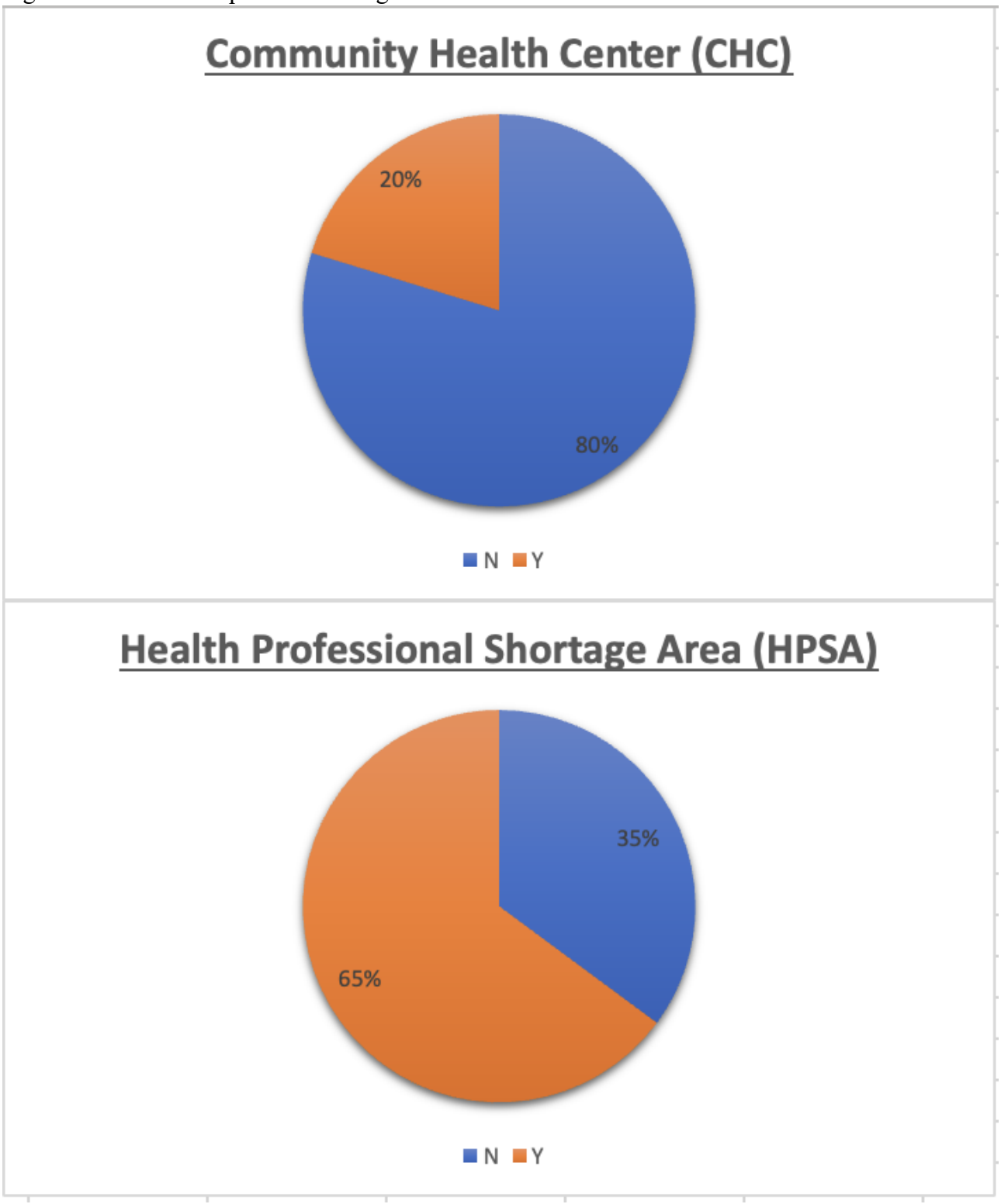


Figure 15. Of the 20% Working in CHC, % of those Working in HPSA Site

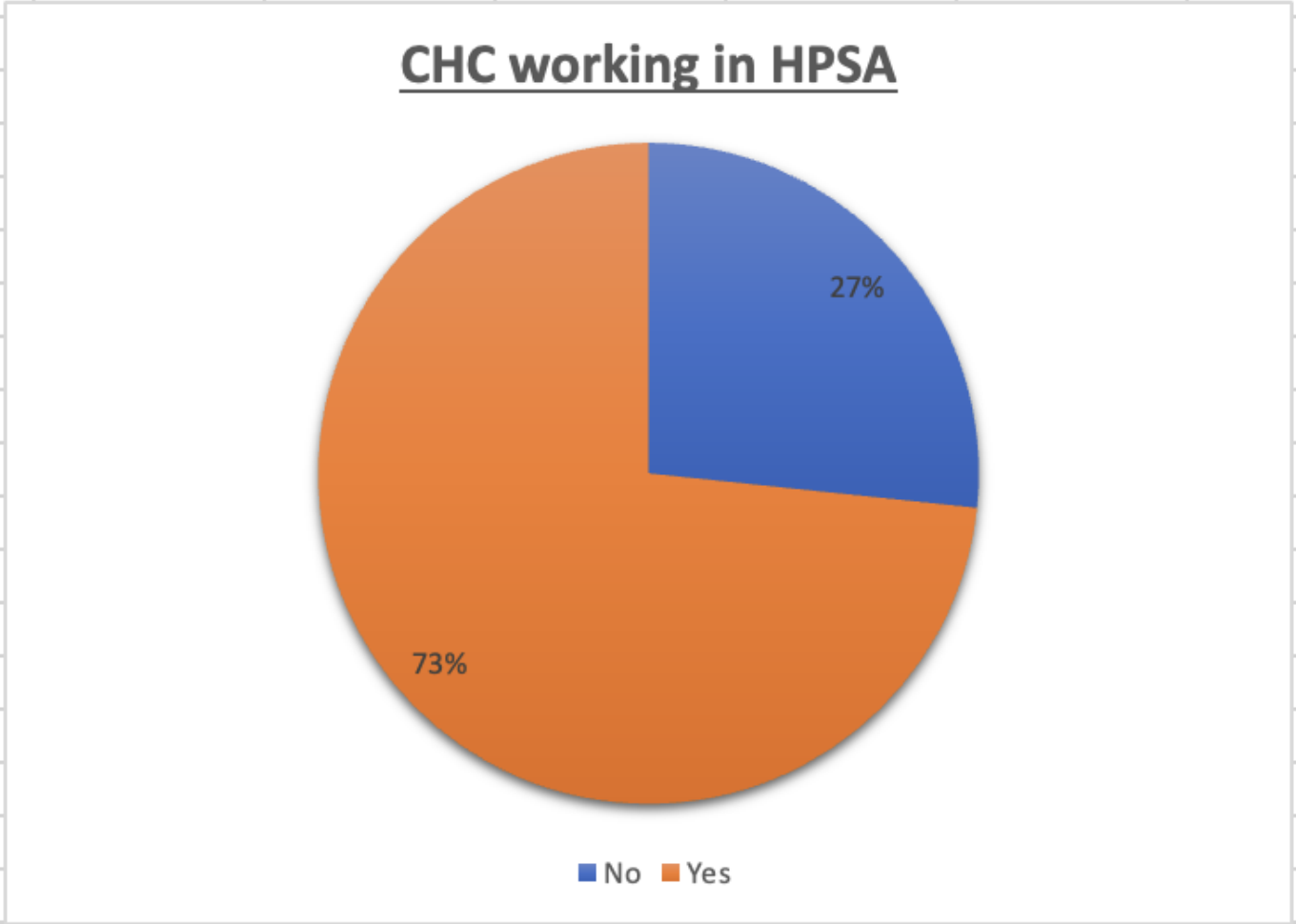


Figure 16. Trends in Rural Practice Over 10-year Timespan

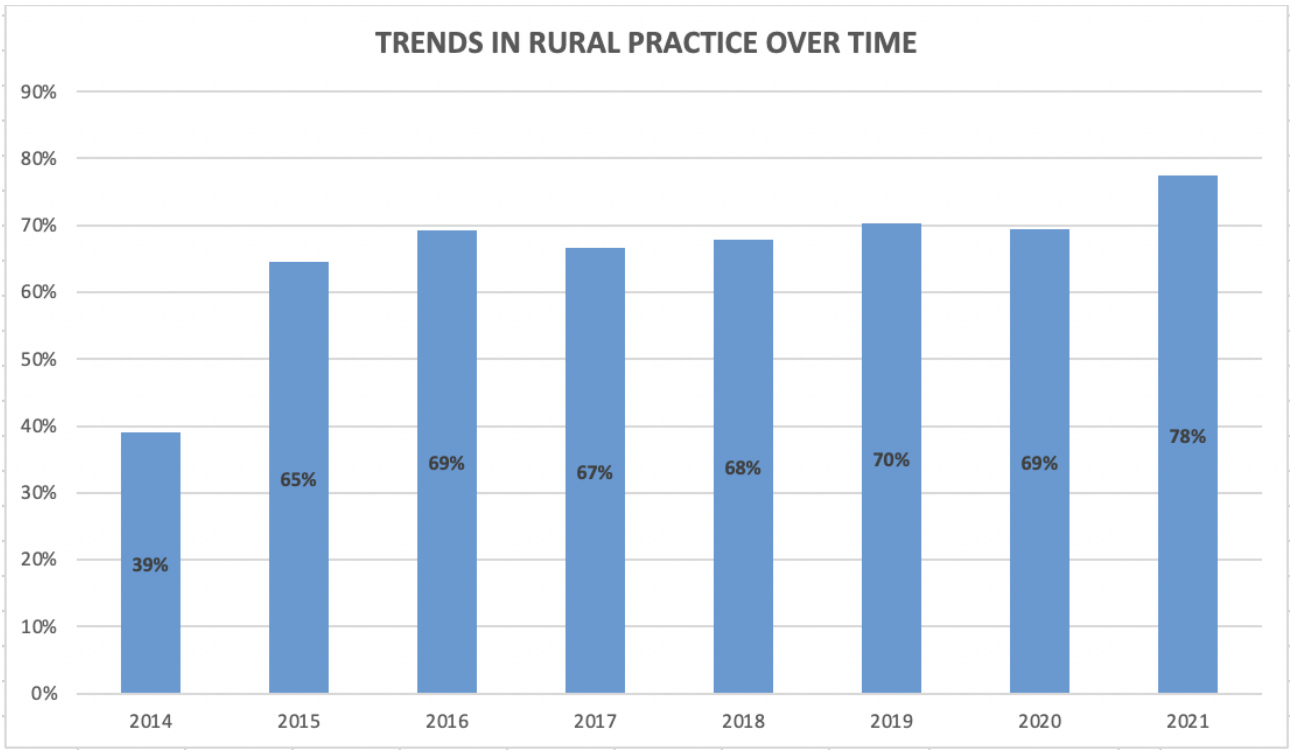


Figure 17. Trends (In state vs. Out-of-state), Practicing in Eastern WA, WWAMI region, and in Rural & Underserved Area)

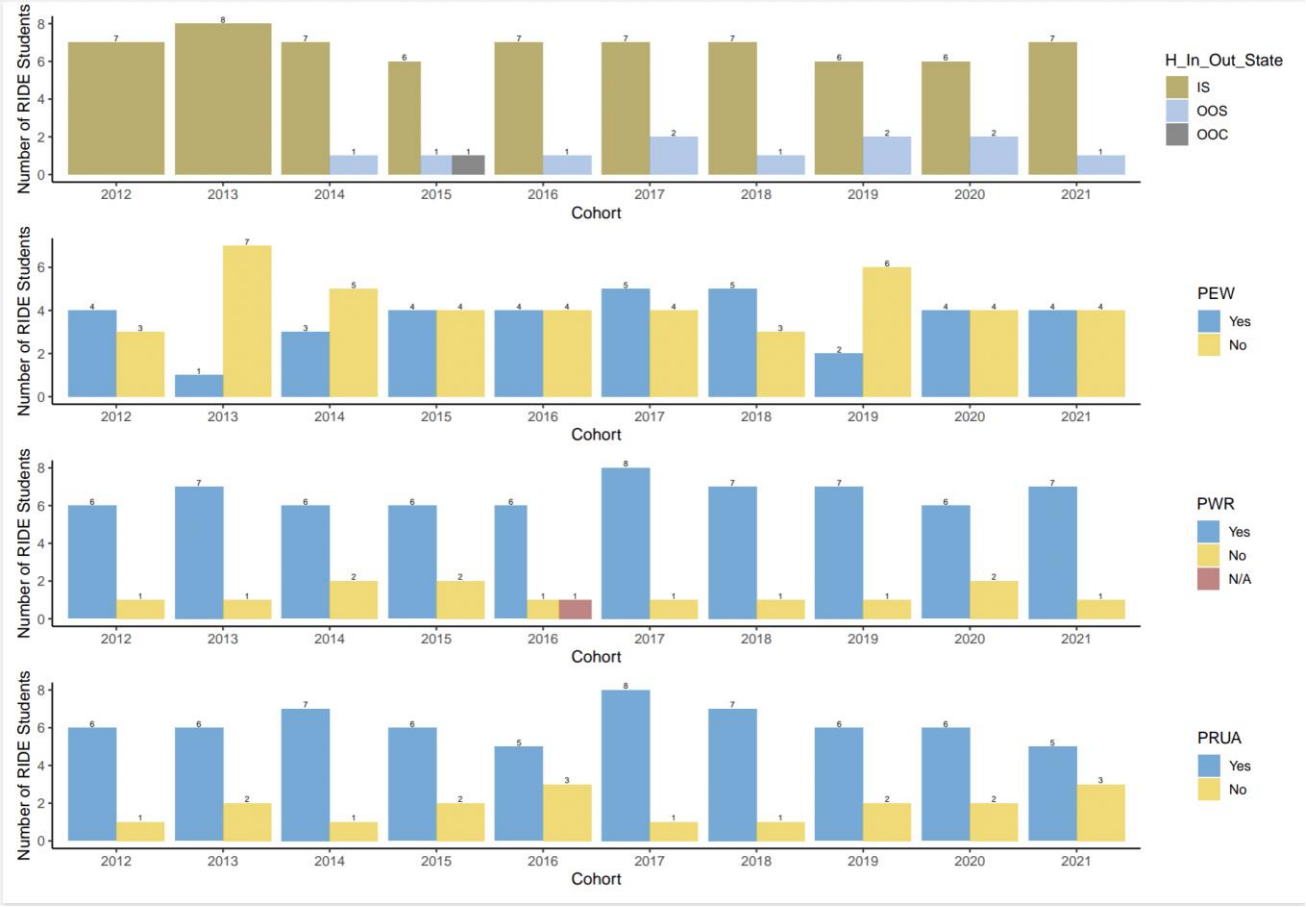
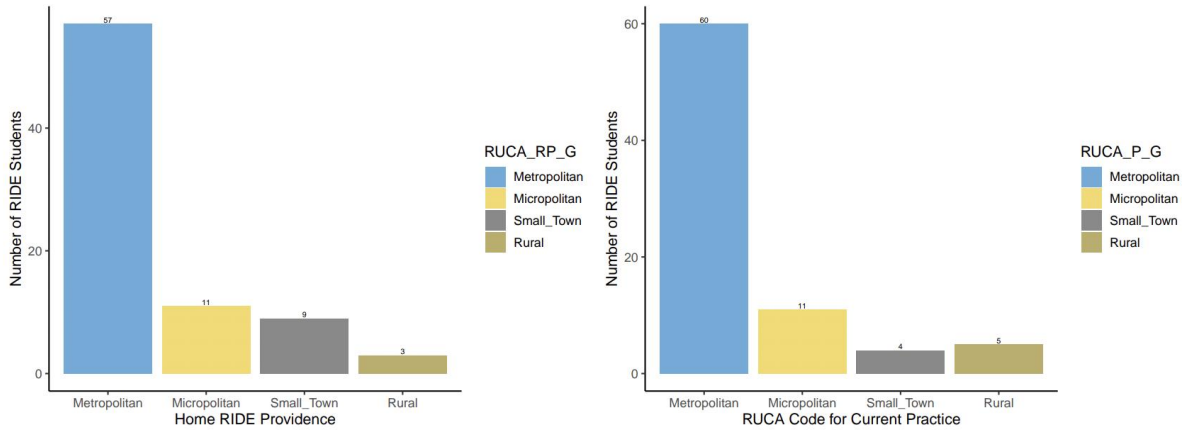


Figure 18. Home RIDE Provenance & Current Practice RUCA Designation



Home RIDE Providence	N	Overall, N = 80[1]	Current Practice RUCA Designation: Metropolitan, N = 60[1]	Micropolitan, N = 11[1]	Small_Town, N = 4[1]	Rural, N = 5[1]	p-value[2]	q-value[3]	Cramer's V[4]
RUCA_RP_G	80						<0.001	<0.001	0.431
Metropolitan		57 (71%)	49 (82%)	5 (45%)	1 (25%)	2 (40%)			
Micropolitan		11 (14%)	8 (13%)	3 (27%)	0 (0%)	0 (0%)			
Small_Town		9 (11%)	3 (5.0%)	2 (18%)	3 (75%)	1 (20%)			
Rural		3 (3.8%)	0 (0%)	1 (9.1%)	0 (0%)	2 (40%)			

[1] n (%)
[2] Fisher's exact test
[3] False discovery rate correction for multiple testing
[4] Cramer's V Effect Size: DF = 4 | Negligible 0 < 0.05 | Small 0.05 < 0.15 | Medium 0.15 < 0.25 | Large > 0.25

Figure 19. Home RIDE Provenance & Current Practice RUCA Designation

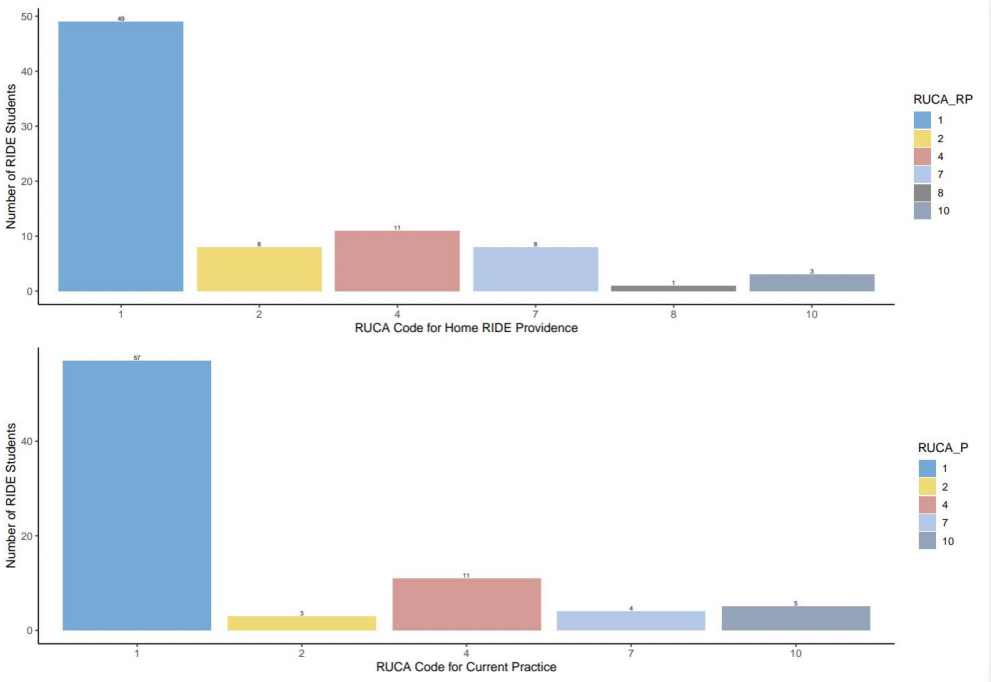
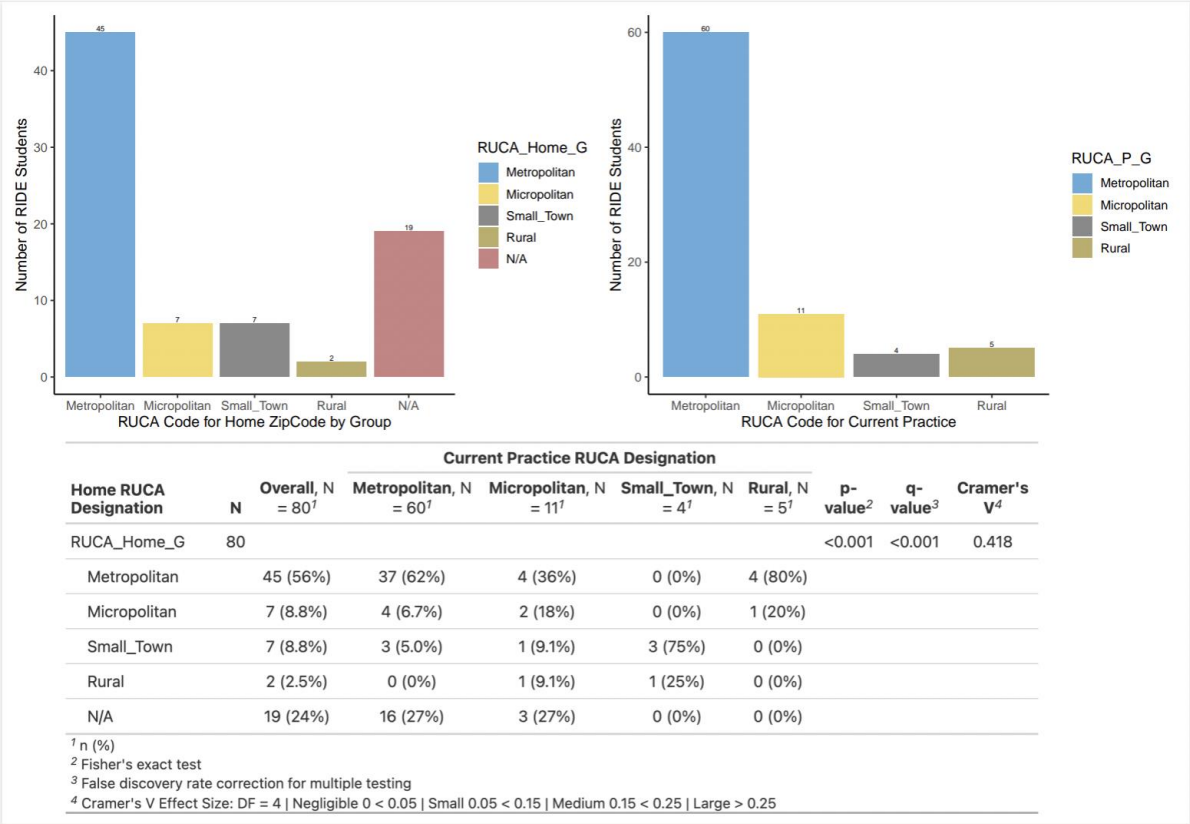


Figure 20. Parental/Home ZIP Code & Current Practice RUCA Designation



		Current Practice RUCA Designation						
Home RUCA Designation	**N**	**Overall**, N = 80[1]	**Metropolitan**, N = 60[1]	**Micropolitan**, N = 11[1]	**Small_Town**, N = 4[1]	**Rural**, N = 5[1]	**p-value**[2]	**q-value**[3]	**Cramer's V**[4]
RUCA_Home_G	80						<0.001	<0.001	0.418
Metropolitan		45 (56%)	37 (62%)	4 (36%)	0 (0%)	4 (80%)			
Micropolitan		7 (8.8%)	4 (6.7%)	2 (18%)	0 (0%)	1 (20%)			
Small_Town		7 (8.8%)	3 (5.0%)	1 (9.1%)	3 (75%)	0 (0%)			
Rural		2 (2.5%)	0 (0%)	1 (9.1%)	1 (25%)	0 (0%)			
N/A		19 (24%)	16 (27%)	3 (27%)	0 (0%)	0 (0%)			

[1] n (%)
[2] Fisher's exact test
[3] False discovery rate correction for multiple testing
[4] Cramer's V Effect Size: DF = 4 | Negligible 0 < 0.05 | Small 0.05 < 0.15 | Medium 0.15 < 0.25 | Large > 0.25

Figure 21. Parental/Home ZIP Code & Current Practice RUCA Designation

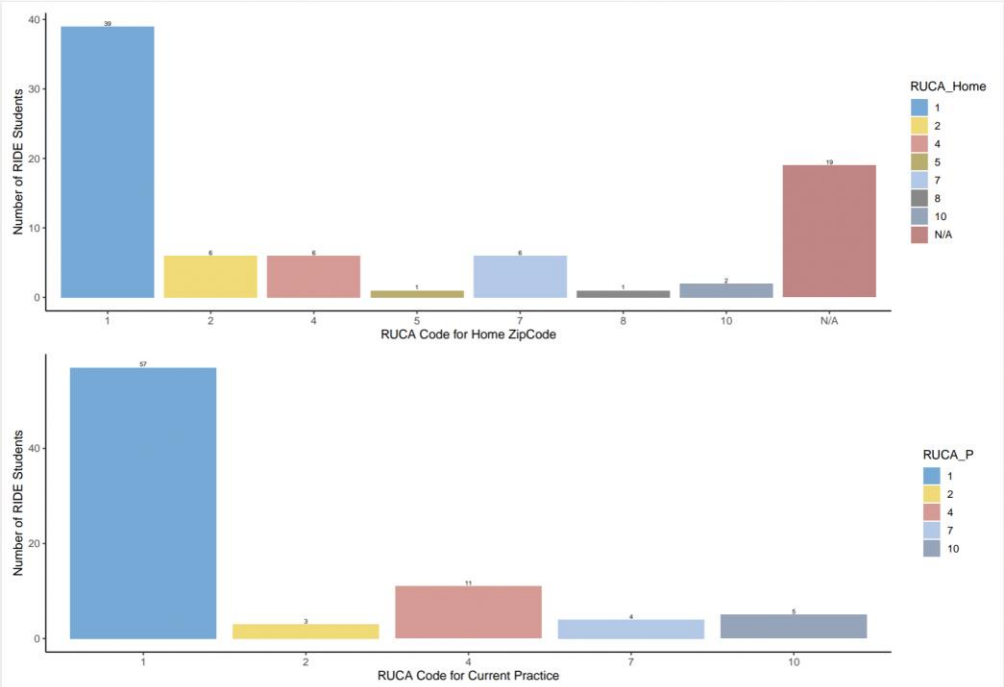
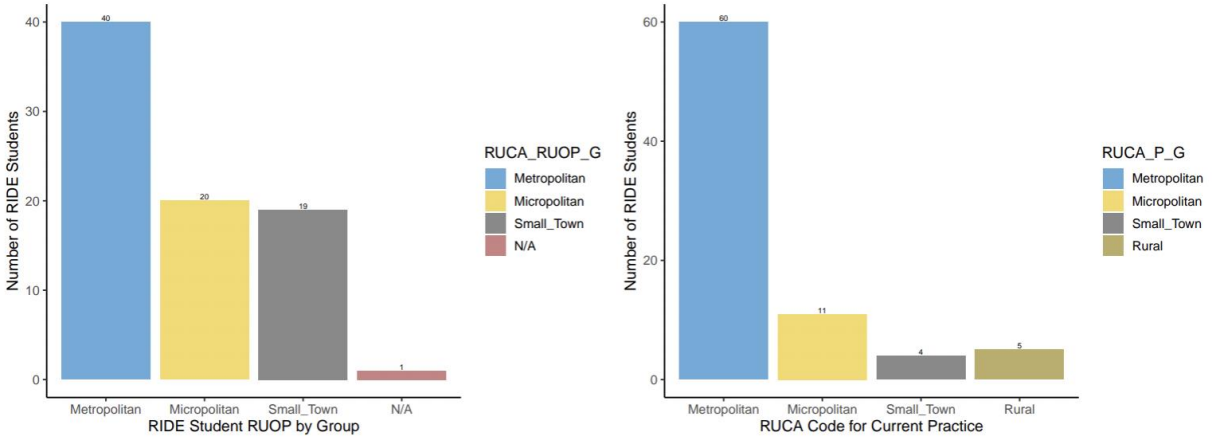


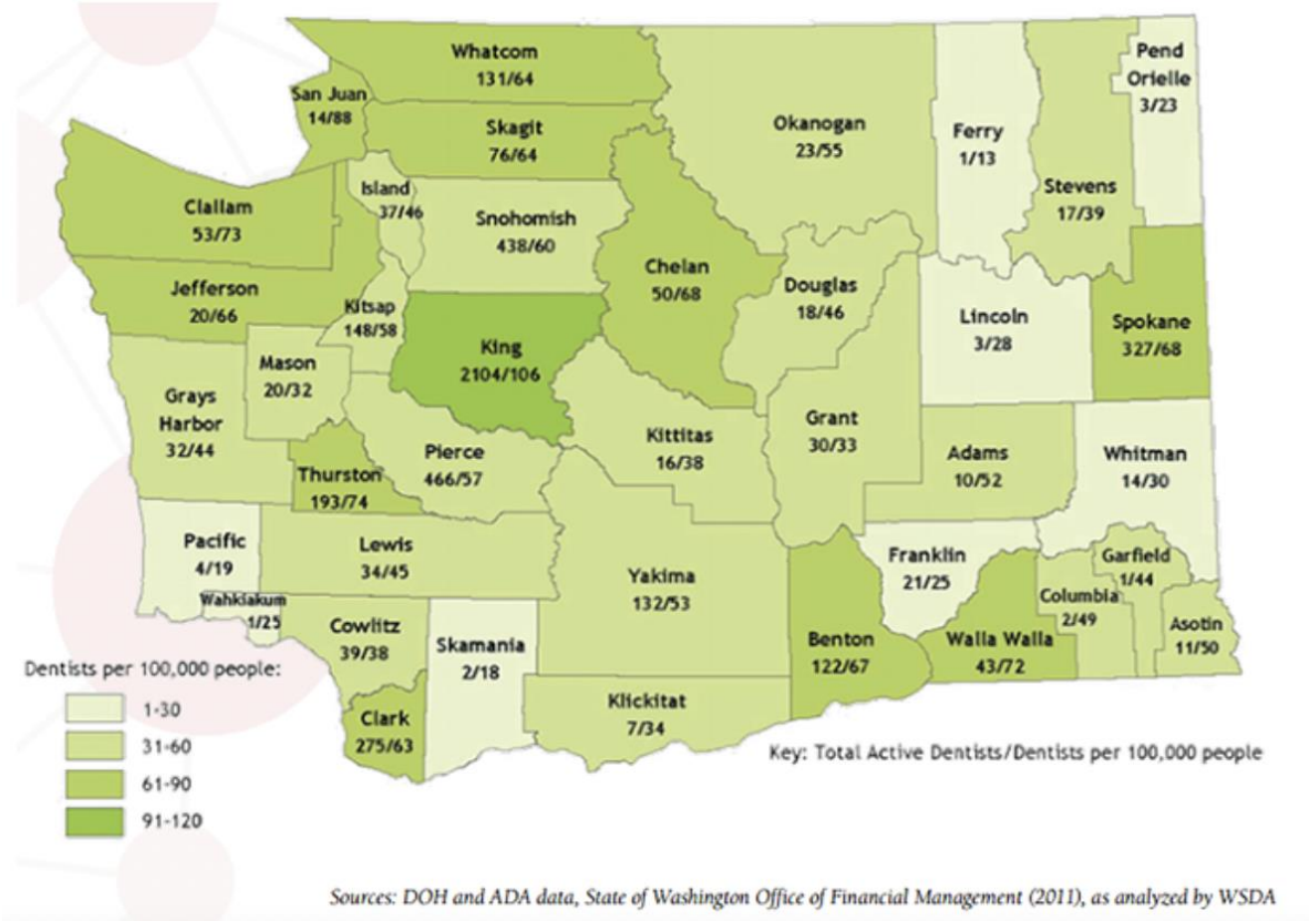
Figure 22. RUOP Training Site & Current Practice RUCA Designation



RIDE Student RUOP RUCA Designation	N	Overall, N = 80[1]	Current Practice RUCA Designation				p-value[2]	q-value[3]	Cramer's V[4]
			Metropolitan, N = 60[1]	Micropolitan, N = 11[1]	Small_Town, N = 4[1]	Rural, N = 5[1]			
RUCA_RUOP_G	80						0.026	0.026	0.246
Metropolitan		40 (50%)	35 (58%)	1 (9.1%)	1 (25%)	3 (60%)			
Micropolitan		20 (25%)	11 (18%)	7 (64%)	1 (25%)	1 (20%)			
Small_Town		19 (24%)	13 (22%)	3 (27%)	2 (50%)	1 (20%)			
N/A		1 (1.3%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)			

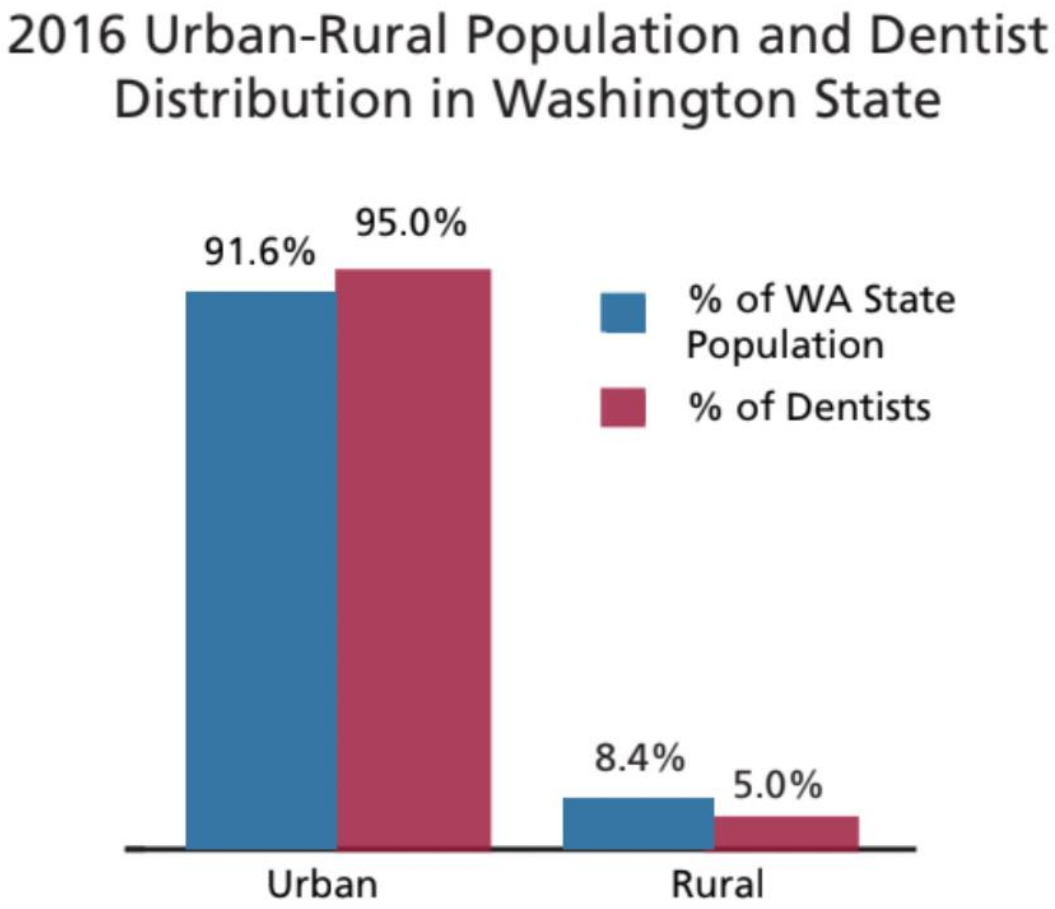
[1] n (%)
[2] Fisher's exact test
[3] False discovery rate correction for multiple testing
[4] Cramer's V Effect Size: DF = 4 | Negligible 0 < 0.05 | Small 0.05 < 0.15 | Medium 0.15 < 0.25 | Large > 0.25

Figure 23. 2012 WSDA Dental Workforce Report[31, 34]



Note: For example, per 2012 report, there was only 1 dentist in Ferry County vs. 2104 dentists in King country. Also, there are 13 dentists per 100,000 people in comparison to 106 dentists per 100,000 people.

Figure 24. Urban and Rural Distribution of WA State Dentists and Population, 2016[38]



Data Source: Washington State Department of Health, Health Professions Licensing Data System, 2016 (August), and Washington State Office of Financial Management Population Data, 2016.

VIII. APPENDIX

I. RUCA Categorization – WWAMI RUCA Rural Health Research Center

The small rural and isolated small rural categories can be combined to create a single "small" rural category: **Categorization B.**

Urban: 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, and 10.1
Large Rural City/Town: 4.0, 4.2, 5.0, 5.2, 6.0, and 6.1
Small and Isolated Small Rural Town: 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, and 10.6

II. Rural Urban Commuting Area (RUCA) Primary Codes Classification System

General Classification	Core Area Codes	High Commuting Primary Flow (at least 30% to Urbanized Area) Codes	Low Commuting Primary Flow (between 10-30% to Urbanized Area) Codes
Metropolitan (Urban) (50,000 or more)	1	2	3
Micropolitan (Large Town) (10,000 - 49,999)	4	5	6
Small Town (2,500 – 9,999)	7	8	9
Rural (Isolated Rural) (under 2,500)	10		

Primary RUCA codes, 2010

Code	Classification description
1	Metropolitan area core: primary flow within an urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30% or more to a UA
3	Metropolitan area low commuting: primary flow 10% to 30% to a UA
4	Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)
5	Micropolitan high commuting: primary flow 30% or more to a large UC
6	Micropolitan low commuting: primary flow 10% to 30% to a large UC
7	Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30% or more to a small UC
9	Small town low commuting: primary flow 10% to 30% to a small UC
10	Rural areas: primary flow to a tract outside a UA or UC

III. Effect Size for Cramer's V accounting for DF

Interpretations for Cramér's V

df*	negligible	small	medium	large
1	0 < .10	.10 < .30	.30 < .50	.50 or more
2	0 < .07	.07 < .21	.21 < .35	.35 or more
3	0 < .06	.06 < .17	.17 < .29	.29 or more
4	0 < .05	.05 < .15	.15 < .25	.25 or more
5	0 < .05	.05 < .13	.13 < .22	.22 or more

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