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Iowa Dentist Workforce Atlas, 1997-2016: 20 Years of the Iowa Dentist Tracking System.

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**Iowa Dentist Workforce Atlas, 1997-2016:
20 Years of the Iowa Dentist Tracking System**

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Although the authors strived to make the information in this atlas as timely and accurate as possible, the authors, Public Policy Center, and College of Dentistry make no claims, promises, or guarantees about the accuracy, completeness, or adequacy of the contents of this report, and expressly disclaim liability for errors and omissions in the contents. Conclusions and analysis generated from these data are not to be considered attributable to either the Public Policy Center or the College of Dentistry.

It could be argued that the health workforce, the people who provide direct patient care, as well as the staff that support caregivers and health care institutions, is the most significant component of the infrastructure of the health care system. Yet as a nation (or state) we have invested very little in collecting and analyzing health workforce data or in supporting the necessary research to inform effective public and private decision making. The results of this lack of investment are surpluses and shortages, significant mal-distribution, and less efficient and effective care than would be possible with better intelligence on our workforce needs.

Edward Salsberg. The health workforce: a critical component of the health care infrastructure. Health Affairs Blog. March 24, 2014.

Health workforce data collection is limited to non-existent.

Catherine Dower. Regulatory challenges to improving oral health care in the U.S. Presented at Institute of Medicine Workshop: US Oral Health Workforce in the Coming Decade. February 10, 2009; Washington, DC.

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Table of Contents

| | |
|---|-----|
| Tables | 5 |
| Figures | 5 |
| Executive Summary..... | 10 |
| Operational Definitions..... | 14 |
| History of Dentist Workforce Monitoring in Iowa | 16 |
| About the Tracking Systems..... | 17 |
| Development..... | 19 |
| Maintenance | 21 |
| Dentist Workforce Inflow and Outflow | 43 |
| Workforce Trends | 50 |
| Sex..... | 50 |
| Race..... | 68 |
| Age | 69 |
| Practice Activity (Other than Private Practice) | 73 |
| Practice Arrangement..... | 87 |
| Urbanicity of Iowa’s Dentist Workforce Location..... | 96 |
| Graduation Year..... | 105 |
| Impact of the University of Iowa College of Dentistry..... | 108 |
| Hours Worked Per Week | 118 |
| Full-Time Versus Part-Time..... | 139 |
| Population-to-Dentist Ratios | 148 |
| Dental Health Professional Shortage Areas..... | 156 |
| County-Level Data..... | 161 |
| Population Change..... | 161 |
| County Economic Typology..... | 163 |
| Pull Factor | 165 |
| Historical Population-to-Dentist Ratios, Mid-1960s and Forward..... | 169 |
| Articles Using Iowa Dentist Tracking System Data | 218 |
| Peer-Reviewed Journal Articles | 218 |
| Non-Peer-Reviewed Journal Articles | 218 |
| University of Iowa Public Policy Center Reports..... | 219 |
| Historical Iowa Dentist Workforce Publications | 220 |

| | |
|---|-----|
| Grants Using Iowa Dentist Tracking System Data..... | 221 |
| Appendix | 222 |

Tables

| | |
|--|-----|
| Table 1. Establishment of Iowa health professions tracking systems | 18 |
| Table 2. Percent of dentists in each practice type, active and private practitioners, 1997 and 2016 | 25 |
| Table 3. Characteristics of private practice Iowa dentists, 1997 and 2016 | 26 |
| Table 4. Cities with the greatest net gain of private practice dentists, 1997-2016..... | 31 |
| Table 5. Cities with the greatest net loss of private practice dentists, 1997-2016 | 31 |
| Table 6. Rural-Urban Continuum Code (RUCC), 2013..... | 97 |
| Table 7. County population-to-dentist (all active) ratios for 1997, 2006, and 2016, listed from lowest to highest for 2016 | 151 |
| Table 8. Iowa's Dental HPSA counties, fall 2017 | 157 |
| Table 9. Iowa counties that had their Dental HPSA designation withdrawn..... | 159 |
| Table 10. Iowa counties that had their Dental HPSA designation reclassified | 159 |
| Table 11. National versus Iowa typology | 164 |
| Table 12. 30 largest Iowa cities, by population (based on 2016 US Census population estimates)..... | 166 |
| Table 13. Questions in annual Iowa workforce study: 1979-1986 | 222 |
| Table 14. Iowa workforce questions that were only asked once during annual survey, 1979-1986 | 224 |
| Table 15. Demographic, education, and employment status of Iowa dentists, 1982-1987..... | 225 |
| Table 16. Median number of weeks worked per year and hours worked per week, Iowa private practice, 1973-1986 | 226 |

Figures

| | |
|---|----|
| Figure 1. Iowa health professions tracking systems | 17 |
| Figure 2. IDTS timeline | 20 |
| Figure 3. Dentists in Iowa, active versus private practice, 1997-2016 | 22 |
| Figure 4. Active health professionals in Iowa, 2000-2016 | 23 |
| Figure 5. Active dentists, private practice dentists, general dentists in private practice, and general dentists in private practice who are less than 60 years old and work full-time..... | 24 |
| Figure 6. Percent of active Iowa dentists who are in private practice, general dentists and specialists, 1997-2016 | 27 |
| Figure 7. Location of Iowa private practice dentists, 1997..... | 28 |
| Figure 8. Location of Iowa private practice dentists, 2006..... | 29 |
| Figure 9. Location of Iowa private practice dentists, 2016..... | 29 |
| Figure 10. Change in number of dentists, by city, between 1997 and 2016 | 30 |
| Figure 11. Location of Iowa private practice general dentists, 2016..... | 32 |
| Figure 12. Number of Iowa dental specialists in private practice, 1997-2016 | 33 |
| Figure 13. Location of private practice endodontists per city, 1997, 2006, and 2016..... | 35 |
| Figure 14. Location of private practice oral surgeons per city, 1997, 2006, and 2016 | 35 |
| Figure 15. Location of private practice orthodontists per city, 1997, 2006, and 2016 | 37 |
| Figure 16. Location of private practice pediatric dentists per city, 1997, 2006, and 2016 | 38 |

| | |
|--|-----------|
| Figure 17. Location of private practice periodontists per city, 1997, 2006, and 2016..... | 39 |
| Figure 18. Location of private practice prosthodontists per city, 1997, 2006, and 2016..... | 40 |
| Figure 19. Location of Iowa primary care physicians, 2015..... | 41 |
| Figure 20. Percent of active Iowa dentists, by sex, birth state, and dental school attended, 1997-2016 . | 42 |
| Figure 21. Iowa dentist workforce inflow and outflow, 1997-2016 | 43 |
| Figure 22. Inflow and outflow for all Iowa dentists, by sex, 1997-2016..... | 44 |
| Figure 23. Reasons for dentist outflow, Iowa, 1997-2016..... | 45 |
| Figure 24. Number of retiring Iowa dentists and mean age at retirement, 1997-2016..... | 46 |
| Figure 25. Characteristics of dentists entering (inflow) Iowa workforce, 1997-2016 (N=1,192) | 47 |
| Figure 26. Characteristics of Iowa dentist retirees, 1997-2016 (N=615)..... | 48 |
| Figure 27. Characteristics of Iowa dentists who relocated to another state, 1997-2016 (N=379) | 49 |
| Figure 28. Active Iowa dentists, by sex, 1997-2016..... | 50 |
| Figure 29. Active Iowa dentists, by sex, 1997-2016..... | 51 |
| Figure 30. Percent of Iowa dentists in private practice, 1997-2016..... | 52 |
| Figure 31. Active and private practice (PP) Iowa dentists, by sex, 1997-2016 | 53 |
| Figure 32. Number of Iowa dental specialists, by sex, 1997-2016 | 54 |
| Figure 33. Percent of active Iowa dentists who are specialists, by sex, 1997-2016..... | 55 |
| Figure 34. Dental public health dentists in Iowa, by sex, 1997-2016 | 56 |
| Figure 35. Endodontists in Iowa, by sex, 1997-2016 | 57 |
| Figure 36. Oral and maxillofacial pathologists in Iowa, by sex, 1997-2016..... | 58 |
| Figure 37. Oral and maxillofacial radiologists in Iowa, 1997-2016 | 59 |
| Figure 38. Oral and maxillofacial surgeons in Iowa, by sex, 1997-2016 | 60 |
| Figure 39. Orthodontists in Iowa, by sex, 1997-2016 | 61 |
| Figure 40. Pediatric dentists in Iowa, by sex, 1997-2016..... | 62 |
| Figure 41. Periodontists in Iowa, by sex, 1997-2016 | 63 |
| Figure 42. Prosthodontists in Iowa, by sex, 1997-2016 | 64 |
| Figure 43. Number of dentists per county, by sex, 2016..... | 65 |
| Figure 44. Age of active dentists, by sex, 2016 (N=1,530)..... | 66 |
| Figure 45. Age of active dentists, by sex, 1997 (N=1,447)..... | 67 |
| Figure 46. Racial composition of Iowa dentist workforce, 1997-2016 | 68 |
| Figure 47. Percent of active Iowa dentists, by age category, 1997-2016 | 69 |
| Figure 48. Age of active Iowa dentists, 1997 and 2016 | 70 |
| Figure 49. Percent of Iowa private practice dentists who are 60 years of age or older, 1997-2016 | 71 |
| Figure 50. Distribution of Iowa active dentists greater than 50 years of age, 1997 and 2016..... | 72 |
| Figure 51. Iowa dentist faculty, by sex, 1997-2016 | 73 |
| Figure 52. Iowa dentists with an administrative position, by sex, 1997-2016 | 74 |
| Figure 53. State or federal government dentists in Iowa, by sex, 1997-2016..... | 75 |
| Figure 54. Hospital-sponsored dentists in Iowa, by sex, 1997-2016 | 76 |
| Figure 55. Veterans Affairs dentists in Iowa, by sex, 1997-2016..... | 77 |
| Figure 56. Full-time research dentists in Iowa, by sex, 1997-2016..... | 78 |
| Figure 57. Community or local health department dentists in Iowa, by sex, 1997-2016..... | 79 |
| Figure 58. Iowa dentist faculty, general dentists versus specialists, 1997-2016..... | 80 |
| Figure 59. Iowa dentists in administrative positions, general dentists versus specialists, 1997-2016 | 81 |
| Figure 60. State or federal government dentists in Iowa, general dentists versus specialists, 1997-2016 | 82 |
| Figure 61. Hospital-sponsored dentists in Iowa, general dentists versus specialists, 1997-2016..... | 83 |

| | |
|--|------------|
| Figure 62. Veterans Affairs dentists in Iowa, general dentists versus specialists, 1997-2016 | 84 |
| Figure 63. Full-time research dentists, general dentists versus specialists, 1997-2016..... | 85 |
| Figure 64. Community or local health department dentists, general dentists versus specialists, 1997-2016 | 86 |
| Figure 65. Percent of Iowa private practice dentists, by practice arrangement, 1997-2016..... | 87 |
| Figure 66. Percent of private practice general dentists and specialists in solo practice, 1997-2016..... | 88 |
| Figure 67. Percent of private practice general dentists in solo practice, by sex, 1997-2016 | 89 |
| Figure 68. Number of private practice general dentists, by sex and practice arrangement, 1997-2016... | 90 |
| Figure 69. Percent of private practice general dentists, by sex and practice arrangement, 1997-2016 ... | 91 |
| Figure 70. Age of Iowa private practice dentists, by practice arrangement, 2016 (N=1,395)..... | 92 |
| Figure 71. Age of Iowa private practice dentists, by practice arrangement, 1997 (N=1,331)..... | 93 |
| Figure 72. Age of Iowa private practice dentists, general dentists versus specialists, 1997 (N=1,343) | 94 |
| Figure 73. Age of Iowa private practice dentists, general dentists versus specialists, 2016 (N=1,395) | 95 |
| Figure 74. Iowa metropolitan counties (in gold), 2013..... | 96 |
| Figure 75. Rural-Urban Continuum Codes (RUCC), Iowa | 98 |
| Figure 76. Percent of Iowa dentists in private practice, by rural practice location 1997-2016..... | 99 |
| Figure 77. Urban and rural Iowa dentists in private practice, by sex, 1997-2016..... | 100 |
| Figure 78. Urban and rural general dentists in private practice, by Iowa nativity, 1997-2016 | 101 |
| Figure 79. Urban and rural general dentists in private practice, by dental school attended, 1997-2016 | 102 |
| Figure 80. Age of Iowa private practice dentists, by urbanicity, 2016 (N=1,395) | 103 |
| Figure 81. Age of Iowa private practice dentists, by urbanicity, 1997 (N=1,343) | 104 |
| Figure 82. Graduation year for active Iowa dentists, by sex, 2016..... | 105 |
| Figure 83. Graduation year for active Iowa dentists, by sex and dental school attended, 2016 | 106 |
| Figure 84. Active Iowa dentists by graduation year, University of Iowa versus other dental schools, 2016 | 107 |
| Figure 85. Number of University of Iowa College of Dentistry graduates, 1883-2016..... | 108 |
| Figure 86. Annual percent of Iowa private practice dentists who are University of Iowa graduates (1997-2016) and/or born in Iowa, 2016..... | 109 |
| Figure 87. University of Iowa graduates (1997-2016) who were practicing in Iowa in 2016, by graduation year | 110 |
| Figure 88. Number of University of Iowa College of Dentistry graduates (1997-2016), by sex | 111 |
| Figure 89. Percent of University of Iowa College of Dentistry graduating class (1997-2016) who were female | 112 |
| Figure 90. Number of male University of Iowa College of Dentistry graduates (1997-2016) who practice in Iowa and born in the state, 2016..... | 113 |
| Figure 91. Number of female University of Iowa College of Dentistry graduates (1997-2016) who practice in Iowa and were born in the state, 2016..... | 114 |
| Figure 92. Number of University of Iowa College of Dentistry graduates (1997-2016) practicing in Iowa, by sex, 2016 | 115 |
| Figure 93. Percent of University of Iowa College of Dentistry graduates (1997-2016) practicing in Iowa, by sex, 2016 | 116 |
| Figure 94. Location of University of Iowa College of Dentistry graduates (1997-2016) in private practice, 2016 | 117 |
| Figure 95. Hours worked per week, on average, for all active Iowa dentists, 1997-2016 | 118 |
| Figure 96. Hours worked per week, on average, all active Iowa dentists, by sex, 1997-2016 | 119 |

| | |
|---|-----|
| Figure 97. Hours worked per week, on average, by all active Iowa dentists, urban versus rural, 1997-2016 | 120 |
| Figure 98. Hours worked per week, on average, by all active Iowa dentists, general dentists versus specialists, 1997-2016..... | 121 |
| Figure 99. Hours worked per week, on average, by all active Iowa general dentists, by sex and location, 1997-2016 | 122 |
| Figure 100. Mean hours per week for Iowa private practice dentists, 1997-2016 | 123 |
| Figure 101. Hours worked per week, on average, by private practice Iowa dentists, by sex, 1997-2016..... | 124 |
| Figure 102. Hours worked per week, on average, by private practice Iowa dentists, by urbanicity, 1997-2016 | 125 |
| Figure 103. Hours worked per week, on average, by private practice general dentists, by sex and practice arrangement, 1997-2016 | 126 |
| Figure 104. Hours worked per week, on average, by private practice Iowa dentists, by general dentists and specialists, 1997-2016..... | 127 |
| Figure 105. Hours worked per week, on average, by private practice Iowa dentists, by combination of sex, location, and specialty, 1997-2016..... | 128 |
| Figure 106. Hours worked per week, on average, by private practice endodontists, by sex, 1997-2016..... | 129 |
| Figure 107. Hours worked per week, on average, by private practice oral and maxillofacial surgeons, by sex, 1997-2016..... | 130 |
| Figure 108. Hours worked per week, on average, by private practice orthodontists, by sex, 1997-2016 | 131 |
| Figure 109. Hours worked per week, on average, by private practice pediatric dentists, by sex, 1997-2016 | 132 |
| Figure 110. Hours worked per week, on average, by private practice periodontists, 1997-2016 | 133 |
| Figure 111. Hours worked per week, on average, by private practice prosthodontists, by sex, 1997-2016 | 134 |
| Figure 112. Hours worked per week, on average, by all private practice dental specialists, 1997-2016..... | 135 |
| Figure 113. Age of private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=1,395) | 136 |
| Figure 114. Age of male private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=1,022)..... | 137 |
| Figure 115. Age of female private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=373)..... | 138 |
| Figure 116. Number of part-time active Iowa dentists, by sex, 1997-2016 | 139 |
| Figure 117. Percent of active Iowa dentists who work part-time, by sex, 1997-2016 | 140 |
| Figure 118. Percent of private practice Iowa dentists working part-time, by practice arrangement, 1997-2016 | 141 |
| Figure 119. Percent of private practice Iowa dentists working part-time, by age group, 1997-2016..... | 142 |
| Figure 120. Female private practice dentists who work part-time, by age category, 1997-2016..... | 143 |
| Figure 121. Male private practice dentists who work part-time, by age category, 1997-2016 | 144 |
| Figure 122. Age of private practice Iowa dentists, by full- versus part-time status, 2016 (N=1395) | 145 |
| Figure 123. Age of female private practice Iowa dentists, by full- versus part-time status, 2016 (N=373) | 146 |
| Figure 124. Age of male private practice Iowa dentists, by full- versus part-time status, 2016 (N=1,023) | 147 |

| | |
|--|-----|
| Figure 125. Population-to-dentist ratios across dentist categories..... | 148 |
| Figure 126. Iowa population-to-dentist ratio changes, by county, 1997-2016 | 150 |
| Figure 127. Counties where the population-to-dentist ratio was greater than 3,000:1 in 1997, 2006, and 2016 | 154 |
| Figure 128. Number of Iowa counties with greater than 3,000:1 population-to-dentist ratios, 1997-2016 (99 Iowa counties)..... | 155 |
| Figure 129. Iowa Dental Health Professional Shortage Areas, 2016 | 156 |
| Figure 130. Population-to-dentist ratio and Rural-Urban Continuum Code, by Dental HPSA status for each Iowa county, 2017 | 160 |
| Figure 131. Estimated population gain/loss in percentages for Iowa counties, 2000-2017 | 161 |
| Figure 132. Iowa county non-overlapping economic typology codes, 2015 | 163 |
| Figure 133. Iowa county pull factor: regional trade patterns, 2017..... | 165 |
| Figure 134. County population-to-dentist ratio trends, 1965 through 2016 | 168 |
| Figure 135. Historical population-to-dentist ratios, Iowa counties, mid-1960s and forward. | 169 |
| Figure 136. Number of Iowa dental specialists in private practice, 1968-1986 | 227 |
| Figure 137. Iowa private practice perceptions about busyness, 1973-1986..... | 228 |
| Figure 138. Type of patient payment for dental services (%), Iowa private practice dentists, 1979-1986 | 229 |

Executive Summary.

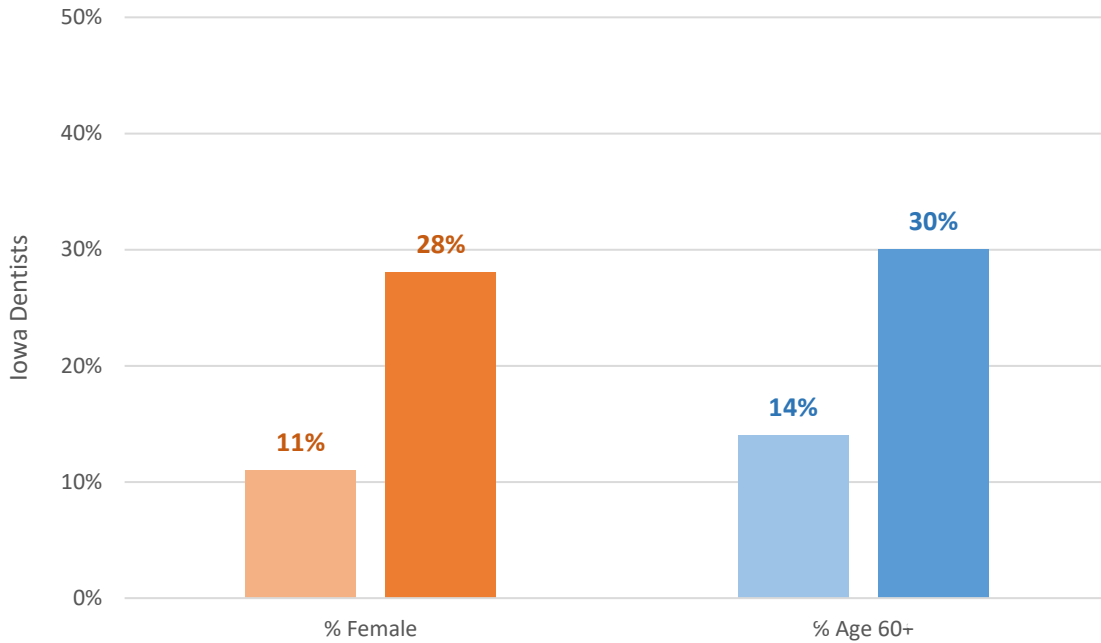
This report describes historical dentist workforce trends in the state of Iowa using data from the Iowa Dentist Tracking System (IDTS). The IDTS is a longitudinal workforce tracking system maintained by the University of Iowa Office of Statewide Clinical Education Programs, which also tracks 4 additional health professions in addition to dentists: physicians, pharmacists, physician assistants, and advance practice nurses. These tracking systems are unique in their comprehensiveness of data collection and maintenance, as well as their longevity. This atlas describes 20 years of historical dentist workforce trends since the inception of the IDTS in 1997.

Key findings from this report are included below, and include only dentists *actively practicing* in the state of Iowa:

The total number of dentists in Iowa increased only 7%, from 1,446 in 1997 to 1,530 in 2016. The statewide population-to-dentist ratio remained constant, from 1,974 Iowans per dentist in 1997 to 2,031 in 2016, demonstrating that the slight increase in total dentists mirrored statewide population trends during this time. The growth in dentist workforce (7%) is far less than the growth among other health professions in Iowa, including physicians (21%), pharmacists (20%), advanced practice nurses (189%), and physician assistants (84%).

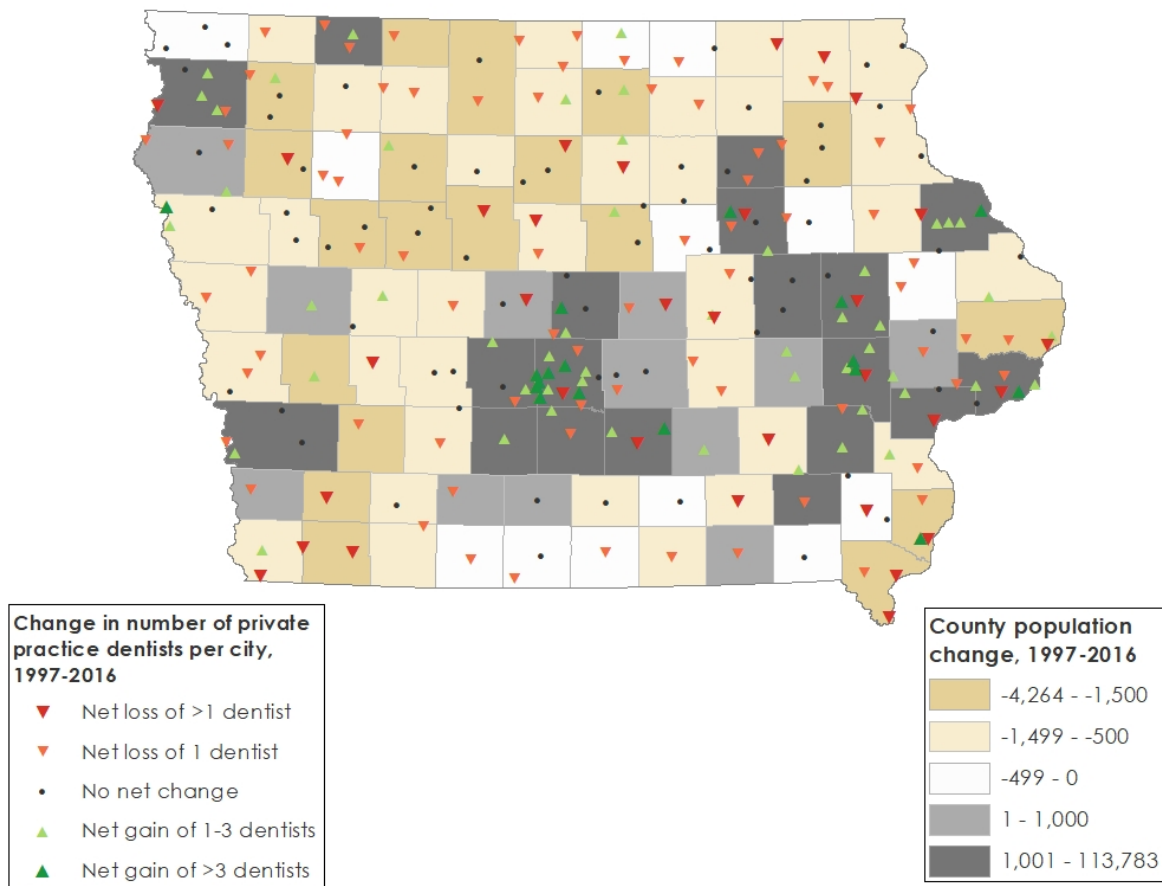
Annually since 1997, more than 9 in 10 Iowa dentists work in private practice, and 8 in 10 are general dentists. The proportion of dentists in private practice has remained constant from 93% in 1997 to 91% in 2016. The proportion of dentists who were in general practice also remained constant from 80% in 1997 to 79% in 2016.

A large male cohort of dentists is approaching retirement with concurrent increases in representation of women in the workforce. Similar to national trends, there was a substantial increase in female representation in the workforce, increasing from only 11% in 1997 to 28% in 2016. The share of dentists aged 60 and older who were predominantly male increased from 14% in 1997 to 30% in 2016.



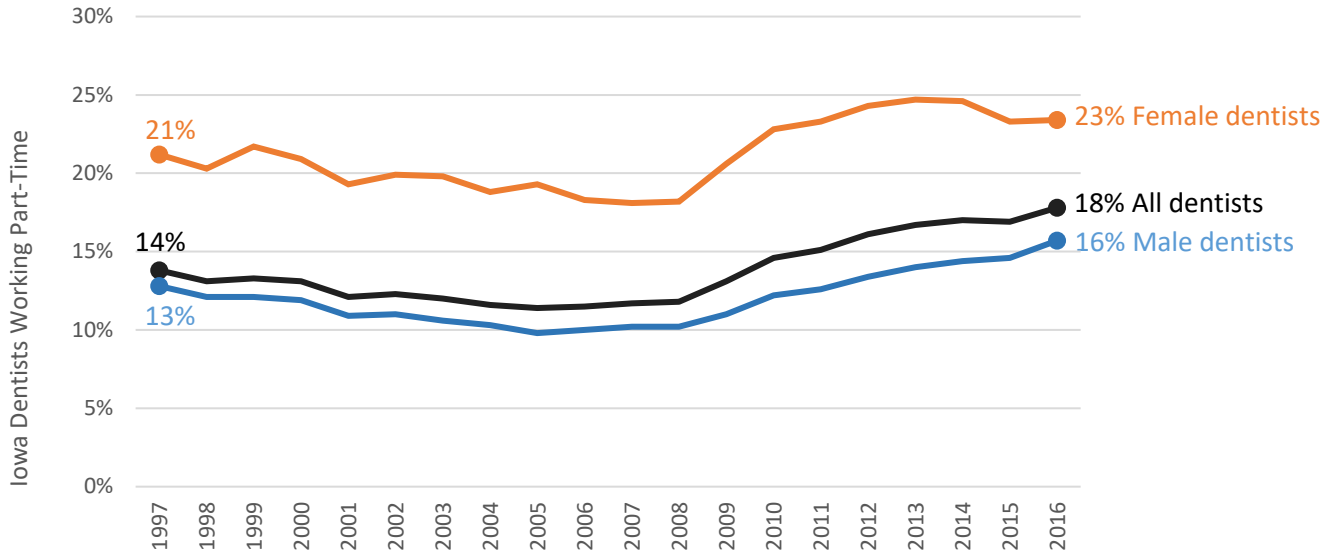
Three-quarters of Iowa dentists are University of Iowa graduates, and over 6 in 10 Iowa dentists were born in Iowa. Whereas the proportion of dentists who graduated from the University of Iowa College of Dentistry has remained stable at 74-75% since 1997, the proportion who were born in Iowa has decreased from 70% in 1997 to 63% in 2016.

A decline in rural dentist supply mirrors population shifts in rural areas of the state. There was a 16% decline in the number of dentists working in rural areas from 1997-2016, and among dentists entering the workforce during this time period, only 28% chose to work in a rural county.



Group practices are now the dominant arrangement for dental care delivery in Iowa. The proportion of private practice dentists working in solo practice declined from 59% in 1997 to 41% in 2016. As of 2008, group practice replaced solo practice as the dominant practice arrangement among Iowa dentists. This is, in part, a function of age, as younger dentists are considerably more likely to go into group practice than solo practice.

Almost 1 in 5 Iowa dentists worked part-time, or less than 32 hours per week, in 2016. This proportion decreased from 13% in 1997 to 11% in 2005 and has steadily increased to 18% in 2016. Female dentists were substantially more likely to practice part-time compared to male dentists throughout the time period; in 2016, 23% of female dentists worked part-time compared to 16% of male dentists.



Twenty-five counties in Iowa have experienced persistent dentist shortages over the past half century. Dentist shortages, as defined by HRSA, have a population-to-dentist ratio of more than 3,000:1. These counties are scattered throughout the state, with the predominant clusters in the south-central region.

The statewide population-to-dentist ratio remained stable at approximately 2,000:1 throughout the study period; however, overall trends mask a declining trend in workforce adequacy. Statewide population-to-dentist ratios that include only private practice, general dentists under age 60 who work full time have increased substantially from 3,266:1 to 4,590:1 during the study period, reflecting shifts in the age distribution and increases in part-time work.

Operational Definitions

Active dentist: an Iowa-licensed dentist who performs the function of a dentist within the state of Iowa. Thus, it does not include dentists who maintain an Iowa license but who practice elsewhere. Active dentists exclude graduate students, interns, and residents who are licensed but still completing their training.

Dental Health Professional Shortage Area (HPSA): a federal designation indicating that there is a shortage of dentists for a specified geographic region, usually a county. HPSAs may either be geographic, population group (i.e., low-income, lack of Medicaid providers), or a facility. The last category includes correctional facilities and Federally Qualified Health Centers (FQHC).

Dental specialist: a graduate from a dental school who has received additional training (2 or more years) in a Commission on Dental Accreditation-approved program in any of 9 American Dental Association-recognized specialties:¹ dental public health, endodontics, oral and maxillofacial pathology, oral and maxillofacial radiology, oral and maxillofacial surgery, orthodontics and dentofacial orthopedics, pediatric dentistry, periodontics, and prosthodontics.

General dentist: a graduate (DDS or DMD) from an accredited US dental school who has not participated in additional post-graduate training in a recognized dental specialty. General dentists also include dentists who have completed either an accredited general practice residency or an advanced education in general dentistry program. Likewise, operative dentistry, which is now recognized by the American Dental Association as an interest area in general dentistry, is considered a general dentist for this report.

Full-time: For this report, a full-time dentist is defined as any active dentist who works 32 or more hours per week, on average, in the field of dentistry. (In recent years the American Dental Association lowered its definition's parameters to apply to any dentist who works 30 or more hours per week.) Earlier Iowa studies (e.g., 1970s and 1980s) that were conducted by other researchers used 35 or more hours per week to define full-time employment.

Practice activity: In the Iowa Dentist Tracking System (IDTS), this refers to the dentist's primary activity. Categories include: private practice, dental school faculty, administration/other, state/federal employment, community health/local government, hospital staff dentist, veterans administration, and research.

Practice arrangement: In the IDTS, this is the organizational type of practice in which the dentist participates. Although there are many subcategories for group practice (e.g., 2 member partnership/association, 3-4 member group/single specialty, 3-4 member group/multi-specialty), for this report we have limited the arrangement types to the following categories: solo practice, group practice, hospital-sponsored practice, other (when the practice activity is dental school faculty), and corporate. Corporate is a newer category, making its IDTS debut in 2011.

Practice attrition (exit or outflow): when a dentist ceased to be an active dentist in Iowa. The most common forms of attrition are retirement and relocation to another state. Other reasons for attrition include death, advanced education, loss of license, and military service.

Practice entry (inflow): when a dentist initially practiced in Iowa.

¹ Dental anesthesiology became the 10th recognized specialty in 2019.

Private practice dentist: Includes dentists whose primary occupation involves patient interaction exclusive of dental school faculty, armed forces, hospital staff, and other federal, state, or local government employees.

Population-to-dentist ratio: The size of the population (for state or county) divided by the number of dentists in the same location (e.g., state or county). For instance, a county with 10,000 residents and 4 dentists would have a population-to-dentist ratio of 2,500:1. Oftentimes, this figure may be expressed as the dentists per XXX population. For the aforementioned example, this would be written as either 4 per 10,000 or 40 per 100,000 population.

Pull factor: Ratio that is calculated by dividing the county's trade area capture by its resident population. A ratio greater than 1 "suggests that the county's merchants are attracting shoppers from outside the county." Conversely, a ratio less than 1 "indicates that the county's retail sector cannot satisfy all of the retail needs of its own residents." The source of these county data is the Retail Trade Analysis Report Fiscal Year 2017, which was developed by Department of Economics, Iowa State University.

Rural-Urban Continuum Codes (RUCCs): The Rural-Urban Continuum Codes are a classification system used by the US Department of Agriculture and approved by the Office of Management and Budget (OMB) to "distinguish metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area." Each county in the United States is assigned one of 9 codes, with 3 metro and 6 non-metro (rural) categories. See Table 6 for descriptions of each category.

Typology (county): The US Department of Agriculture classifies all U.S. counties "according to six mutually exclusive categories of economic dependence" including: farming, mining, manufacturing, federal/state government, recreation, and non-specialized. See page 163 for information about how each category was developed.

History of Dentist Workforce Monitoring in Iowa

Iowa has keen respect for the importance of health workforce monitoring for planning and research. The state has collected county-level data about various health care professions since at least the 1960s.

Fifty years ago, Donald Galagan, dean, University of Iowa College of Dentistry and former assistant surgeon general of the US Public Health Service, made the following observations about the dentist workforce in a guest editorial for the *Iowa Dental Journal* (1968):

- “The present number of active dentists (about 1250) is 22% less than it was in 1940, when 1,623 active dentists served a smaller number of people.”
- “Over the past forty years the number of graduates from the College of Dentistry staying in Iowa has slowly decreased from about 85% to about 55% at the present time.”
- “Non-Iowa graduates do not constitute an important source of practitioners for the state.”
- “Nearly one-half of Iowa’s practicing dentists are over 50 years old, and 1 in every 7 now is at least 70 years old.”
- “The University of Iowa, in collaboration with the Iowa State Dental Association, has initiated a “Practice in Iowa” program in order to persuade more graduates to remain in the state.”
- Noted plans to expand from 62 to 96 graduates when a new facility was available (in 1973).

As Dean Galagan indicated, there had been an increase in class size secondary to an infusion of federal funds to construct newer dental education facilities nationwide, including the construction of a new building for the University of Iowa College of Dentistry. However, there was some concern by the dental profession that the increase in class size would oversaturate the dental market.

After a decade of increasing class sizes throughout the country, this expansion came to an abrupt halt in the 1980s. There was a concern within the profession due to the confluence of several factors – most notably the greater than anticipated increases in community water fluoridation coupled with a decline in permanent tooth caries prevalence among schoolchildren. Additionally, the Federal Trade Commission had removed restrictions for dental advertising and there were extreme fluctuations in the silver and gold market, both of which were the predominant metals used for dental restorations. Corporate dental offices in malls, including locations within Sears department stores, were beginning to appear. These trends, combined with a very small number of dentist bankruptcies, motivated dental alumni to apply sufficient political force such that dental schools reduced class sizes to previous levels.

During this time period the Iowa Dental Association convened an ad hoc Manpower Committee (1978-1987) that diligently conducted annual reviews to monitor several trends, including numbers of patient visits and new patients, changes in office personnel, and practice busyness (see Tables 13 and 14 in Appendix). Similar to the national scene, there was concern within the Iowa dentist community about maintaining balance between disease prevalence, demand for care, and the number of dentists available to meet this demand. By the late 1980s, this ad hoc committee was disbanded. However, the University of Iowa College of Dentistry attempted to maintain some of these voluntary monitoring efforts.

By the mid-1990s, the Office of Statewide Clinical Education Programs (University of Iowa College of Medicine) reinitiated efforts to monitor the dental profession similar to physician monitoring that had been ongoing since the 1970s. Infused with state funds, the Iowa Dentist Tracking System was created.

About the Tracking Systems

The Office of Statewide Clinical Education Programs (OSCEP) is administratively located within the University of Iowa Carver College of Medicine, where it tracks the supply and distribution of several health professions. OSCEP has been conducting continuous inventory of physicians in the state since 1977. In 1994, the Iowa General Assembly approved a state-supported program, the Primary Care Initiative, to increase the number of primary care physicians educated in the state. During the following year, the initiative was expanded to include measures that would help legislators and public health officials understand the status of other health professions in the state. Some of the associated funds were designated to establish and maintain the Iowa Health Professions Inventory, a series of databases tracking Iowa's physicians, dentists, pharmacists, physician assistants, and advanced nurse practitioners (Figure 1). Although similar information is collected across professions, each data set is autonomous. OSCEP is responsible for the daily operations of the tracking systems.

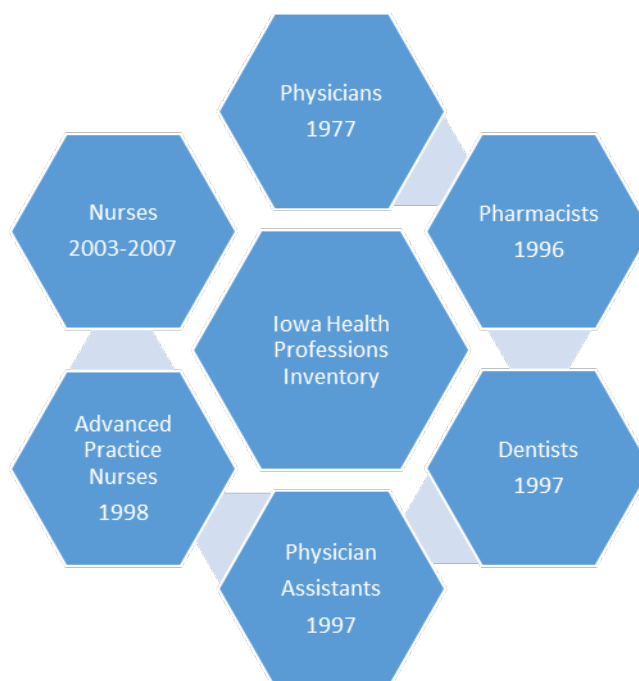


Figure 1. Iowa health professions tracking systems

OSCEP works with the respective professional state boards to share information about changes in the practitioner's status (e.g., non-renewal of license, loss of license, inactive status) and any new information collected by an electronic news-clipping service. The service identifies items news releases such as those related to announcements of new associates, office closures, and obituaries. OSCEP also shares findings with the Bureau of Oral and Health Delivery Systems, Iowa Department of Public Health, which aids in preparation of applications for Medical and Dental Health Shortage Area designations.

The dentist tracking system was initiated in 1997; the long-standing Iowa Physician Information System served as the model. By 1998, pharmacist, physician assistant, and advanced nurse practitioner tracking

systems were also operational (Table 1). The state tracking systems have four principal uses: recruitment (e.g., targeting locations for present and possibly future shortage areas), administrative and planning (e.g., shortage area analysis, grant applications, market research), workforce analysis (e.g., supply and distribution, turnover rate, attrition, primary and satellite sites), and research (e.g., impact of sex on workforce, impact of foreign-trained physicians).

Table 1. Establishment of Iowa health professions tracking systems

| Provider | Established | Number of Providers at Baseline |
|------------------------------------|--------------------|--|
| Physician | 1977 | 3,022 |
| Pharmacist | FY96* | 2,320 |
| Dentist | FY97 | 1,443 |
| Physician assistant | FY98 | 394 |
| Nurse advanced practitioner | FY98 | 553 |

*Iowa's state fiscal year (FY) is July through June. FY97 indicates that the Iowa Dentist Tracking System was operational between July 1996 and June 1997.

In the mid-2000s, OSCEP explored the possibility of creating and maintaining a tracking system for nurses. However, the relative size of the nursing profession combined with high job mobility and the high prevalence of multiple jobs made this endeavor cost prohibitive. Although the dental hygiene profession is relatively small compared to nursing, these professions share similar features, including a substantial proportion of each working for more than one provider.

The monitoring process is guided by a dental advisory committee, consisting of representatives from the Iowa Dental Association, Iowa Dental Board, and the University of Iowa College of Dentistry. The advisory committee provides input concerning selection of specific data elements to be collected, definition of data fields for specific elements, identification of other potential data sources, and adoption of user guidelines and policies for this tracking system. The advisory committee meets annually to review data from the previous calendar year and to suggest modifications. A summary report is published annually and made available to the Advisory Committee for comments prior to being available on the OSCEP website.

The primary purposes of the annual reports are to describe the Iowa Dentist Tracking System and to identify potential state trends in dentist workforce composition. When it is appropriate, comparisons are made with the other professional tracking systems. IDTS provides state data for researchers interested in studying the supply side of the dentist workforce and offers a data collection model that may be useful to other less urbanized states. IDTS characterizes the health professional population (e.g., age, sex, practice arrangements, number of hours worked), monitors trends, and facilitates research on the dentist workforce. Because each tracking system is longitudinal, users are able to track changes in supply and geographic distribution.

This atlas provides a descriptive analysis of the state's dentist workforce for 20-year period since its inception, 1997 through 2016. Topics of particular interest include changes in the composition of dentist sex, age, hours worked, practice arrangements, and retention of University of Iowa graduates in the state. The atlas also assesses geographical trends in the Iowa dentist workforce distribution, including distribution relative to other health care providers. Findings can be used to assist with recruitment and retention efforts, particularly in rural areas of Iowa.

Development

Upon creation of the Iowa Health Professions Inventory, OSCEP staff constructed a dentist survey for the initial round of data collection in 1997 to collect demographic, educational, and practice/employment information. OSCEP and its advisory committee worked diligently to notify licensed dentists that such a monitoring system was being developed and would commence in that same year. OSCEP collaborated with the Iowa Dental Board (IDB) and the state and local dental societies to locate all practice sites. IDB provided some basic information for the eventual database, including license number and date of issue, date of birth, and sex. This provided the foundation for inquiring about additional relevant practice information.

Because the address on file with the IDB could have been for a dentist's office, residence, or post office box, OSCEP took additional steps to identify practice addresses. They purchased all Iowa phone directories, contacted potential employers of dentists (academic institutions, hospitals, insurance companies, and public health and other state and local agencies), scoured through a news-clipping service for information about new practitioners, and performed an online search to locate dentists and their practice sites.

Using these preliminary data, OSCEP staff mailed a partially completed personalized questionnaire to each dentist. An accompanying introductory letter included a list of advisory committee members and informed dentists about the collection of some basic monitoring variables. Dentists were asked to verify the completed information and complete the remainder of the questionnaire. Dentists were notified that OSCEP staff would contact them via telephone to complete the remainder of the survey. Dentists were encouraged to contact advisory committee members, the Iowa Dental Association, or OSCEP staff if they had questions about the survey.

When contacted by telephone, dentists were asked to validate licensure information and were asked the remaining questions. This approach helped to legitimize the data collection process. If there was difficulty in contacting the dentist, the cover letter and survey form were mailed 2 additional times to convey the importance of this project. Eventually, all known dentists were contacted and completed the questionnaire. Most importantly, a contact person in each office was identified to facilitate follow-up.

Besides confirming licensure information, dentists were asked to provide other demographic data, including birth state. OSCEP staff also asked each dentist to confirm the dental school attended and graduation year, along with asking about any advanced dental education (i.e., specialty, general practice residency, or advanced education in general dentistry) and the completion year of that educational program. Employment data included information about principal professional activity (e.g., private practice, government, academia, community health center, Veterans Affairs, hospital), address of primary and additional practice locations, contact information, and practice arrangement. Practice arrangement was initially classified as either solo, associateship, 2-member partnership, or group practice (single or multi-specialty). With the rise in the number of corporate practices throughout the

country, OSCEP added an additional category to the practice arrangement variable in 2011. Other practice information included employment start date, hours worked per week, and weeks worked per year.

The first cycle of data collection for dentists was completed in 1997. For several years, data were collected about dental auxiliaries employed in dentists’ offices. The advisory committee proposed that dental auxiliary data be discontinued in 2008 due to substantial anecdotal evidence that there was an over-count (Figure 2). For example, dental hygienists who worked in multiple offices were being counted in each office.

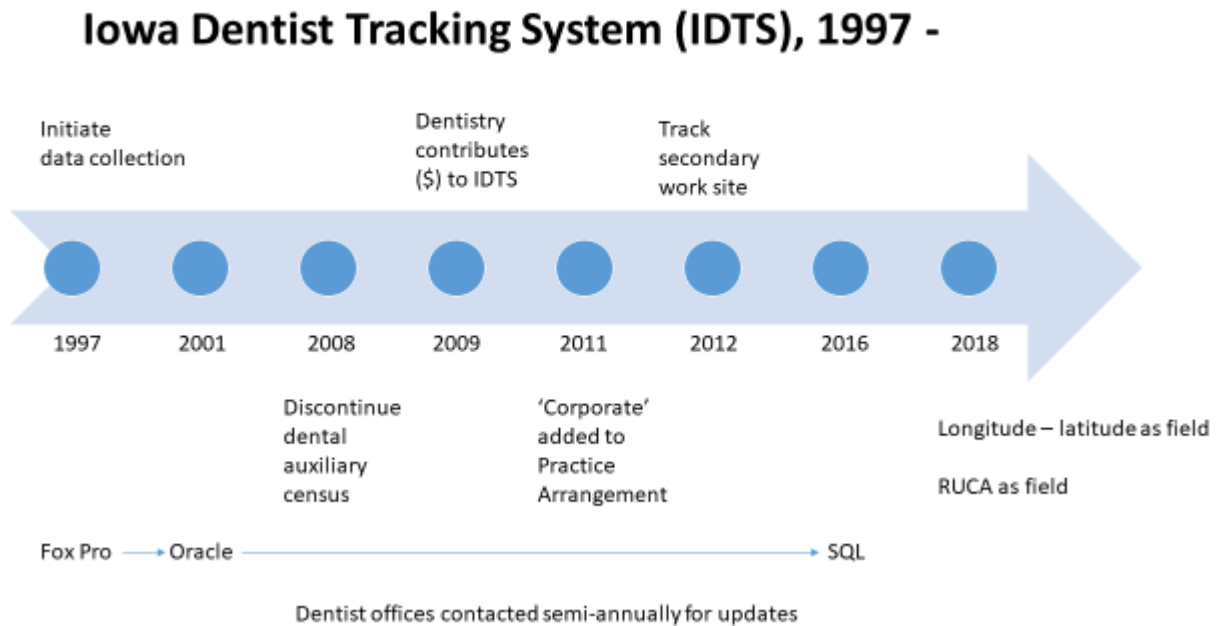


Figure 2. IDTS timeline

Initially, funding for each health profession’s tracking system came from state funds associated with the Iowa Primary Care Initiative. When these state funds were reduced in 2009, dentistry and pharmacy sought other sources. The University of Iowa Colleges of Dentistry and Pharmacy both contributed to partial funding of OSCEP staff. In the case of dentistry, the Iowa Dental Association also contributed some funding for approximately 4-5 years.

For several years the advisory committee requested additional information about the location of any additional work sites beyond the primary practice location. This variable was added in 2012.

With the availability of computer software for geocoding practice location, a field was added to the data base that provided the longitude and latitude of the practice. OSCEP also introduced a field to identify practice urbanicity, using Rural-Urban Commuting Area (RUCA) codes.

The lower portion of Figure 2 shows the shift in relational data-basing during this time period.

Maintenance

OSCEP keeps the database current by collaborating with the Iowa Dental Board to identify new dentists and individuals who have notified the board about a change in address or practice status (e.g., active to inactive). OSCEP continues its subscription to an Iowa electronic newspaper service to identify those entering or leaving the system via relocation or death. Additionally, OSCEP corresponds with institutions where there are regular transitions, such as the University of Iowa College of Dentistry and other public facilities. Once a dentist is included in the database, OSCEP staff contacts the dentist's office semiannually by telephone to update information. For instance, staff inquire about changes with secondary or tertiary practice sites or practice arrangement, such as whether the practitioner still employs an associate.

OSCEP also asks about changes in the number of hours practiced per week and weeks worked per year since their previous contact with each dentist. From its onset the Advisory Committee operationally defined part-time employment as dentists who practice less than 32 hours per week. Dentistry is the only Iowa tracking system to define full- and part-time. Other tracking systems record only number of hours worked per week. Previously, Bognanno et al (1976 Survey of Dentists, unpublished data from the Iowa State Department of Health, December 1976) used 35 or more hours per week to define full-time.

Collecting information about hours per week and weeks per year helps account for individuals who are temporarily absent from the workforce (e.g., due to health or pregnancy) and dentists in phased retirement. The master file is updated monthly, with an annual list recorded as of December 31 of each year.

The University of Iowa College of Dentistry was fortunate to have received funding for several years to assist with the development of a database suitable to address research questions. Delta Dental of Iowa Foundation provided seed funds in 2007 to establish the original research database. Subsequently, the College of Dentistry received 6 years of federal funding from the US DHHS Health Resources and Services Administration, in part, to study the Iowa dentist workforce. This atlas was funded by a Delta Dental of Iowa Foundation grant to commemorate the 20th anniversary of the first IDTS report.

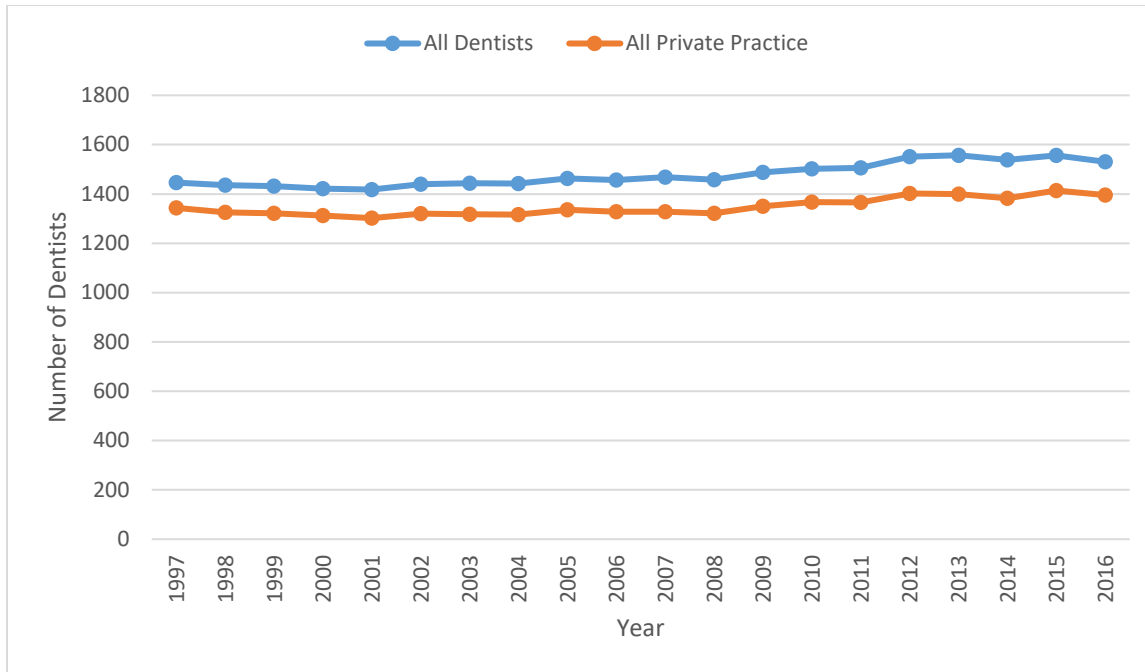


Figure 3. Dentists in Iowa, active versus private practice, 1997-2016

Active Dentists

In 2016, there were 1,530 dentists actively practicing in Iowa. This is considerably lower than the number of dentists with an Iowa license, many of whom do not practice in the state. For example, in 2016 the Iowa Dental Board indicates that there were 2,086 dentists with a full license,² along with 60 dentists with restrictive faculty licenses and 64 dental residency licenses.³

Private Practice Dentists

The percent of active dentists in private practice has remained stable during the 20-year period between 1997 and 2016. In 1997, 92.9% of active dentists were private practitioners, while 91.2% were in private practice in 2016.

This proportion ranged from a low of 89.9% (2013 and 2014) to a high of 92.9% (1997).

² DHHS, Health Resources and Services Administration. The US health workforce, state profiles. <https://bhw.hrsa.gov/health-workforce-analysis/state-profiles>. Published August 2018. Accessed January 8, 2019.

³ Iowa Dental Board. Iowa Dental Board 2017 annual report. https://dentalboard.iowa.gov/sites/default/files/documents/2019/01/2017_annualreport_final.pdf. Published April 16, 2018.

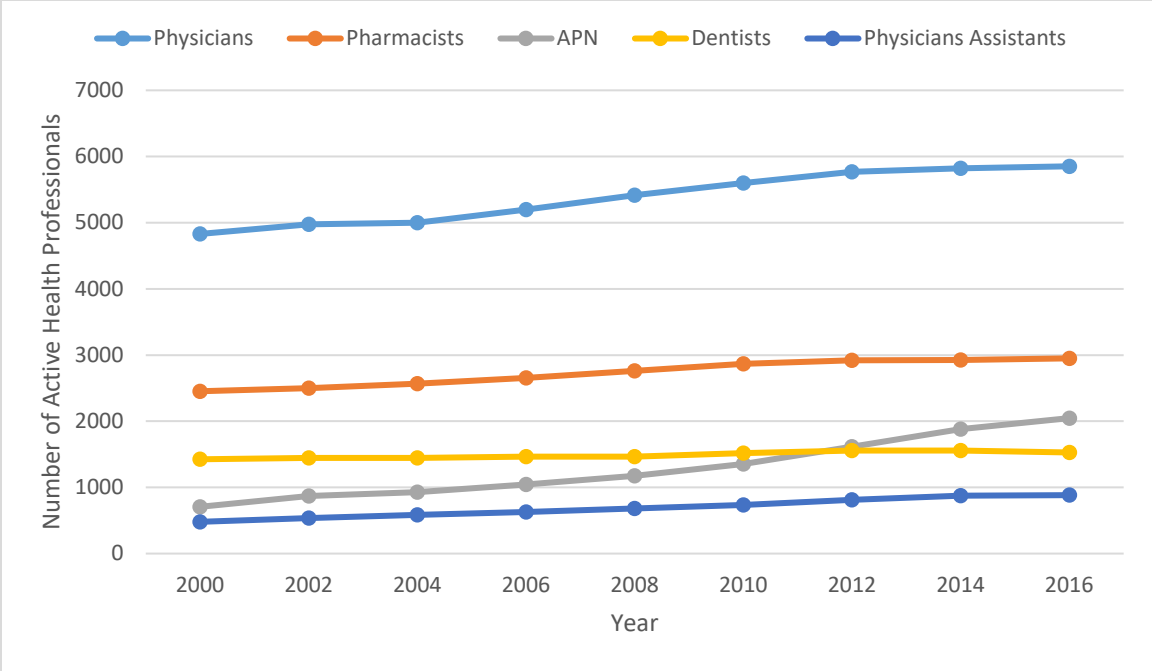


Figure 4. Active health professionals in Iowa, 2000-2016

Although 4 of the tracking systems were initiated in the late 1990s, all systems were not fully operational until 2000. Thus, this chart displays findings from 2000 through 2016.

The number of physicians increased by 21% from 2000 to 2016 and pharmacists increased by 20%. advanced practice nurses (APN) and physician assistants had the largest gains with 189% and 84% increases, respectively. The dentist workforce had the smallest growth (7%) among all professions.

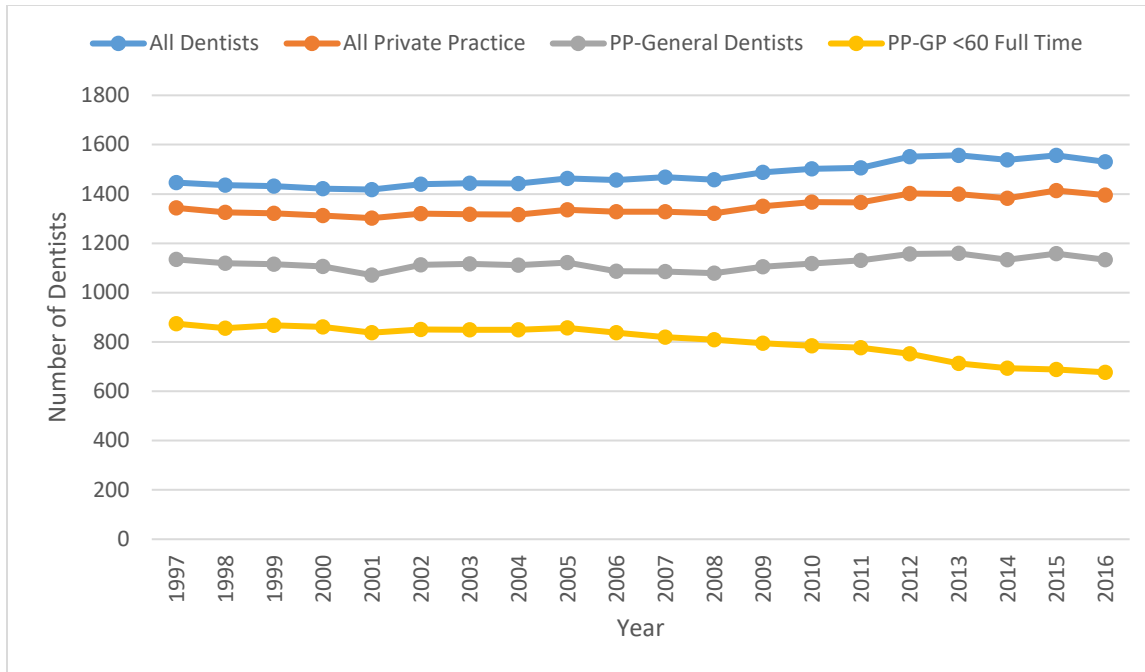


Figure 5. Active dentists, private practice dentists, general dentists in private practice, and general dentists in private practice who are less than 60 years old and work full-time⁴

Among all active dentists, the percent of dentists who were general practitioners ranged from 73.7% (2014) to 78.5% (1997).

Among private practitioners, the percent of dentists who were general dentists ranged from a low of 81.2% (2016) to a high of 84.7% (2003).

Similarly, the percent of dentists who were private practice, general practitioners who were less than 60 years of age and worked full-time ranged from a low of 44.2% (2015 and 2016) to a high of 60.5% (1999 and 2000).

Among private practitioners, between 59.8% (2016) and 78.2% (2001) were general dentists who were less than 60 years of age and worked full-time.

In 1997, 60.4% of Iowa dentists were general practitioners in private practice, younger than 60 years of age and worked full-time. By 2016, this had decreased to 44.2%.

As a reference for this figure, the numbers of dentists in 2016 were 1,530 active dentists, 1,395 private practitioners, 1,133 general dentists in private practice, and 677 general dentists in private practice under 60 years of age and working full-time.

⁴ **PP-General Dentists:** private practice, general dentists in private practice in Iowa.

PP-GP <60 Full Time: private practice, general dentists under age 60, working full-time. Full-time is operationally defined as working 32 hours or more in the field of dentistry.

Table 2. Percent of dentists in each practice type, active and private practitioners, 1997 and 2016

| Dentist Type | 1997 (N=1,446) | | 2016 (N=1,530) | |
|----------------------------------|----------------------------|---------------------------------------|----------------------------|---------------------------------------|
| | Percent of Active Dentists | Percent of Private Practice (N=1,343) | Percent of Active Dentists | Percent of Private Practice (N=1,395) |
| General practice* | 80.4% | 84.5% | 79.1% | 81.3% |
| Orthodontist | 5.9% | 5.9% | 5.6% | 5.9% |
| Oral & maxillofacial surgeon | 3.6% | 3.4% | 4.6% | 4.4% |
| Pediatric dentist | 2.7% | 2.2% | 3.7% | 3.6% |
| Endodontist | 1.9% | 1.6% | 2.7% | 2.6% |
| Prosthodontist | 2.0% | 1.0% | 1.7% | 0.9% |
| Periodontist | 1.9% | 1.4% | 1.6% | 1.2% |
| Dental public health | 0.6% | | 0.8% | |
| Oral & maxillofacial pathologist | 0.4% | | 0.3% | |
| Oral & maxillofacial radiologist | 0.1% | | 0.1% | |

* Includes 6 (1997) and 9 (2016) operative dentists

Nearly 80% of all active Iowa dentists at both ends of this time period were general dentists.

Orthodontists comprised the largest group of dental specialists in the state, accounting for almost 6% of all practitioners and 27% of dental specialists. The percent of general dentists in Iowa mirrors the percent of general dentists nationally (78.5%).⁵

Percentages differ slightly between the columns for active and private practice dentists because specialists in dental public health, oral & maxillofacial pathology, and oral & maxillofacial radiology do not maintain private practice offices in Iowa.

The Iowa Dentist Tracking System includes operative dentists as a separate category because there is an advanced education program in operative dentistry at the University of Iowa College of Dentistry. However, since this is not a recognized American Dental Association specialty, we have included these dentists in the general practice category.

⁵ American Dental Association, Health Policy Institute. Supply of dentists in the U.S.: 2001-2018. <https://www.ada.org/en/science-research/health-policy-institute/data-center/supply-and-profile-of-dentists>

Table 3. Characteristics of private practice Iowa dentists, 1997 and 2016

| | All Private Practice | General Practice | Specialists |
|-----------------|-----------------------------|-------------------------|--------------------|
| 1997 | N=1,343 | N=1,135 | N=208 |
| Female | 10.5% | 11.4% | 5.8% |
| Solo practice | 53.8% | 57.2% | 44.9% |
| Full-Time | 85.7% | 85.6% | 83.6% |
| Urban | 55.3% | 53.3% | 76.9% |
| Mean age (s.d.) | 46.6 (11.1) | 46.6 (11.1) | 46.9 (9.7) |
| 2016 | N=1,395 | N=1,134 | N=261 |
| Female | 25.9% | 27.1% | 23.2% |
| Solo practice | 39.6% | 40.9% | 25.8% |
| Full-Time | 82.4% | 81.8% | 86.7% |
| Urban | 66.0% | 62.6% | 80.5% |
| Mean age (s.d.) | 48.6 (13.1) | 48.7 (13.4) | 48.5 (11.9) |

In 1997, 15.5% of private practitioners were dental specialists. In 2016, 18.8% of private practitioners were dental specialists, and 21.4% of all Iowa active dentists were dental specialists.

Female dentists increased from 10.5% of private practitioners (1997) to 25.9% (2016).

Among all private practitioners, the percentage of private practitioners who were in solo practice declined from 53.8% to 39.6%. The percentage of private practitioners working 32 or more hours per week (defined as full-time) slightly declined from 85.7% to 82.4%.

The percentage of private practitioners who practiced in an urban county increased from 55.3% to 66.0%.

The mean age of private practice dentists increased 2 years from 46.6 to 48.6 years.

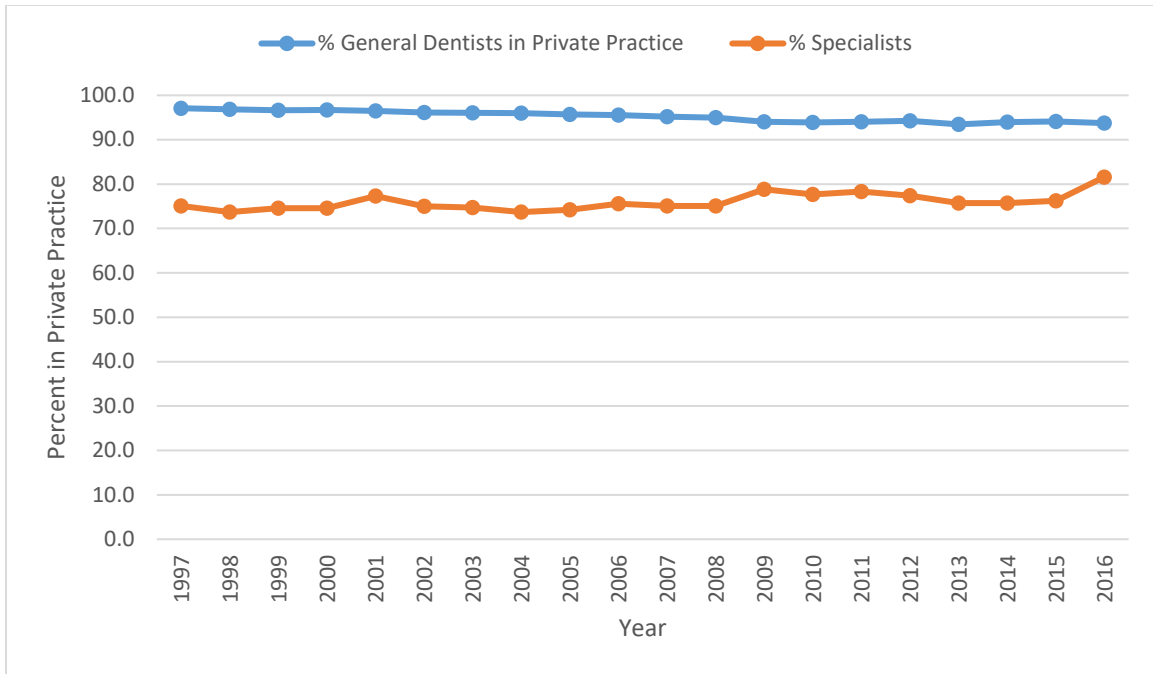


Figure 6. Percent of active Iowa dentists who are in private practice, general dentists and specialists, 1997-2016

Since 1997, there has been a gradual decline in the percent of general dentists who were in private practice from a high of 97.1% in 1997 to a low of 93.5% in 2013.

Dental specialists in private practice ranged 73.7% (1998 and 2004) to 81.6% (2016) of all specialists.

Part of the discrepancy between general dentists and dental specialists was that a disproportionate number of specialists were employed at the University of Iowa College of Dentistry and the University of Iowa Hospital and Clinics.

Figures 7-9 indicate geographical distributions of private practice dentists over time. The size of the violet circle indicates the relative cadre of dentists for that community. Each county is categorized into one of 4 groups based on the size of the population. The darker the shade of the county, the more heavily populated the county at that time period.

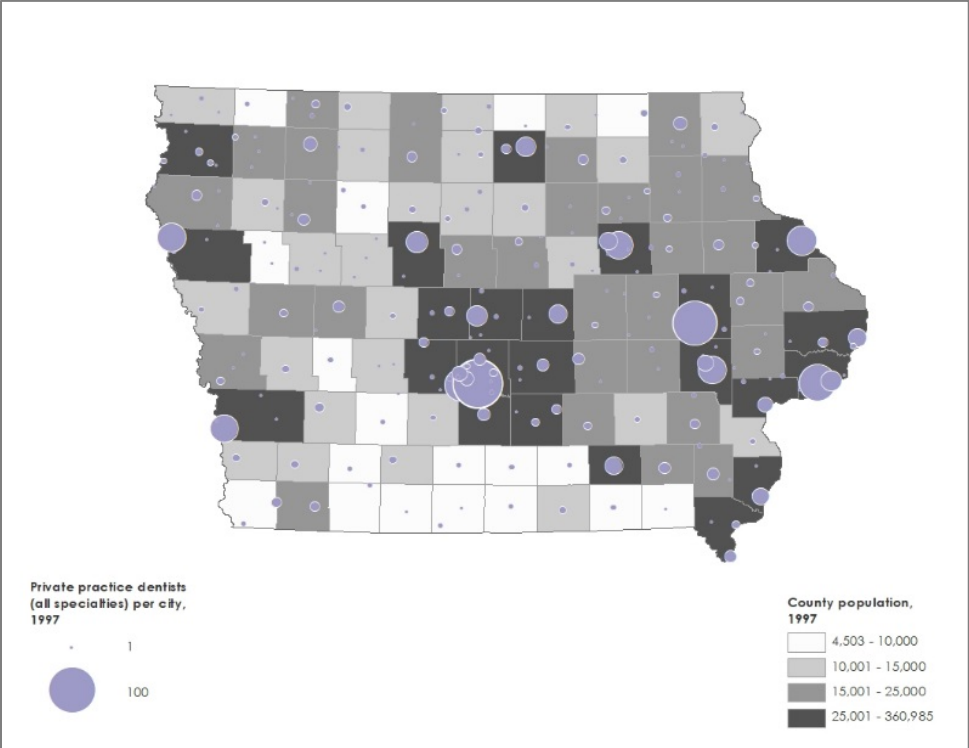


Figure 7. Location of Iowa private practice dentists, 1997

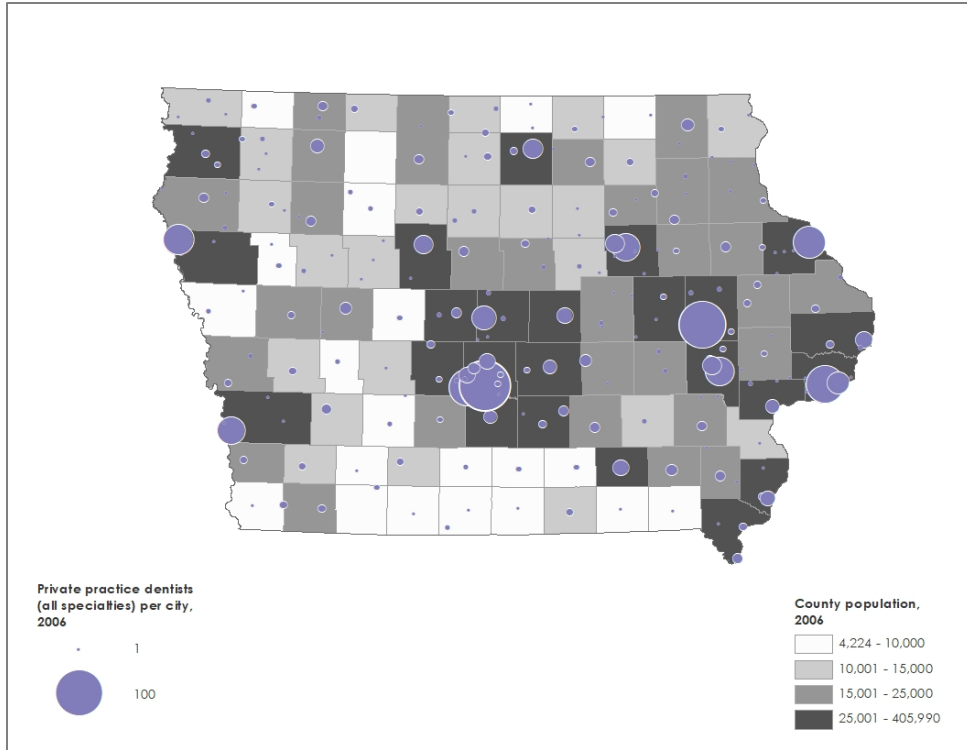


Figure 8. Location of Iowa private practice dentists, 2006

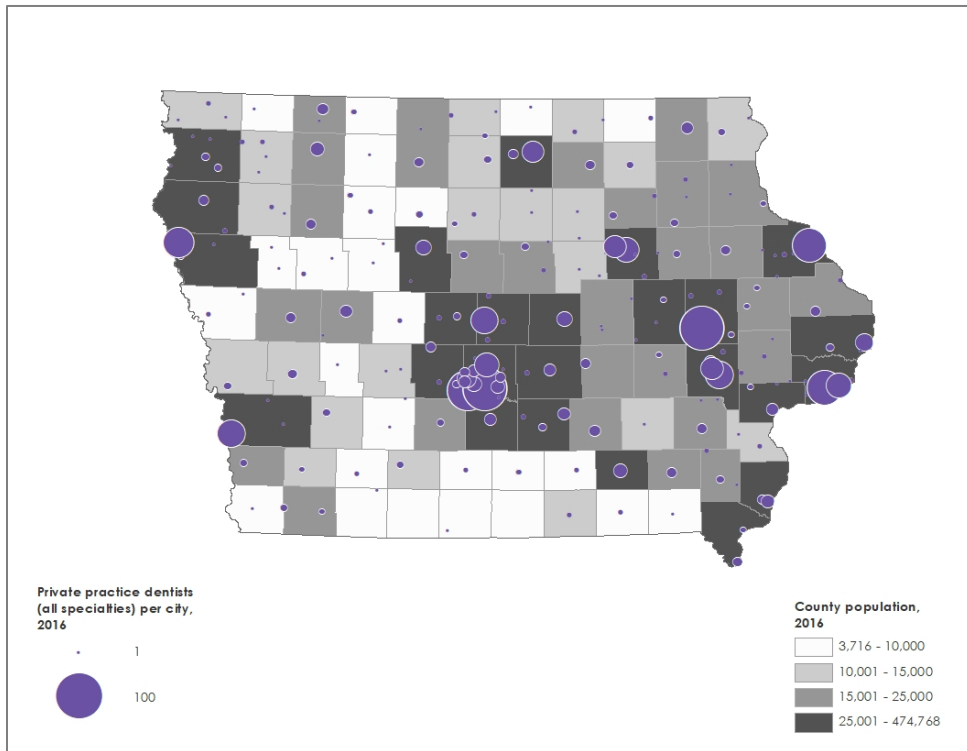


Figure 9. Location of Iowa private practice dentists, 2016

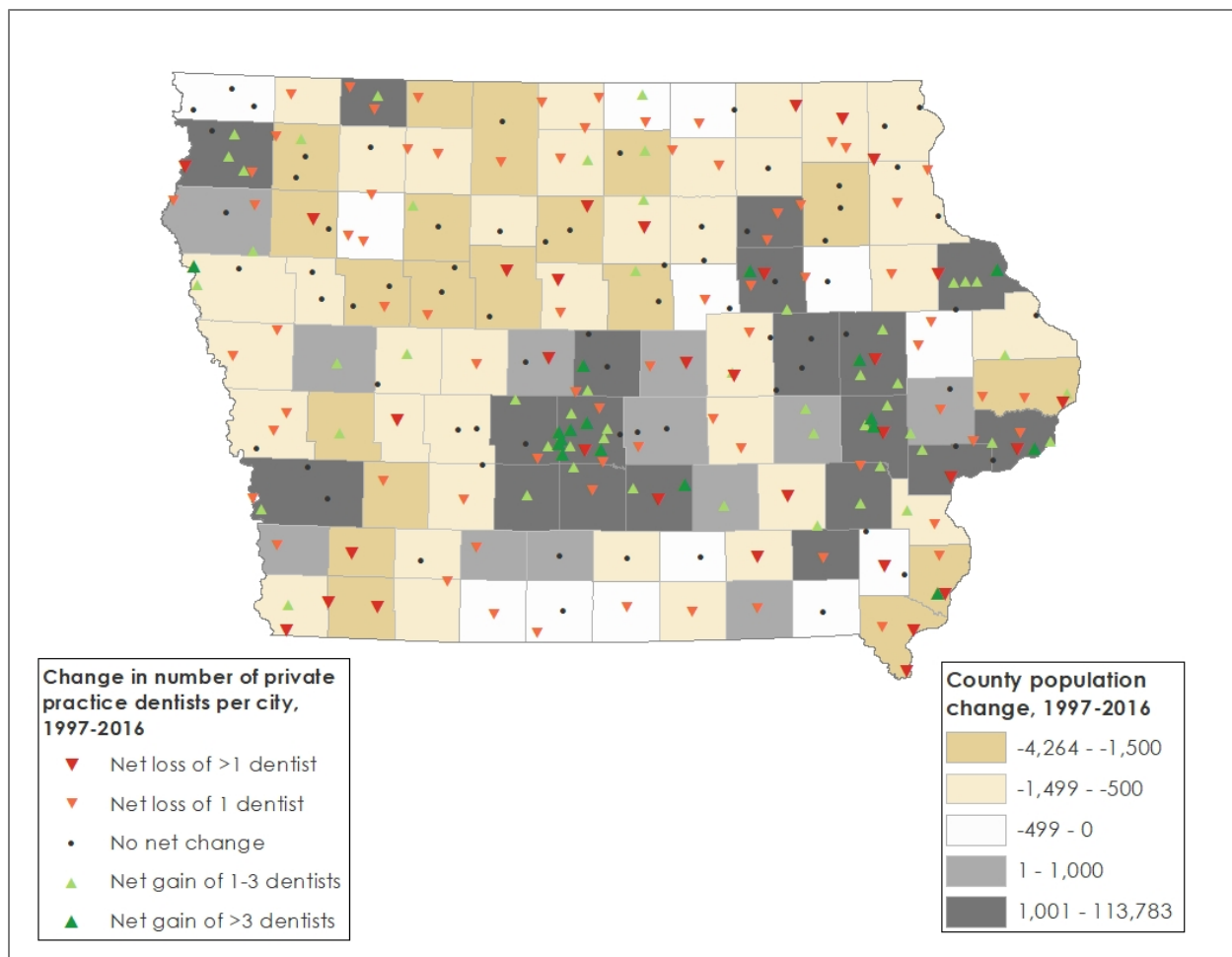


Figure 10. Change in number of dentists, by city, between 1997 and 2016

This map indicates change in the number of dentists within a community and, if so, whether the direction was positive (green arrow pointed up) or negative (red arrow pointed down). The background shade for each county represents the relative population change during this 20-year period. Tables 4 and 5 list communities with the largest net gains/losses for private practice dentists from 1997 through 2016.

Approximately 30% of Iowa cities with any private practice dentists did not have any net change from 1997 through 2016. Cities without any dentists are not represented in this calculation.

Table 4. Cities with the greatest net gain of private practice dentists, 1997-2016

| City | Net gain |
|-----------------|----------|
| West Des Moines | 27 |
| Ankeny | 21 |
| Dubuque | 15 |
| Ames | 15 |
| Sioux City | 11 |
| Coralville | 11 |
| Bettendorf | 10 |
| Cedar Falls | 10 |
| Pleasant Hill | 10 |
| North Liberty | 8 |

Several communities experienced a substantial net gain during this 20-year period, in part either due to natural community population growth or practitioners no longer desiring office locations in a larger community's downtown sections.

Overall, 27.5% of Iowa cities showed a net gain in the number of private practice dentists.

Table 5. Cities with the greatest net loss of private practice dentists, 1997-2016

| City | Net loss |
|----------------|----------|
| Des Moines | 16 |
| Fort Dodge | 9 |
| Iowa City | 8 |
| Burlington | 6 |
| Muscatine | 5 |
| Hampton | 3 |
| Keokuk | 3 |
| Marion | 3 |
| Mount Pleasant | 3 |
| Clarinda | 3 |
| Ottumwa | 3 |
| Shenandoah | 3 |

In many cities throughout the United States, there has been a shift during the past few decades for the location of dental practices, from downtown urban sites to many suburban communities. The most striking example within Iowa is Des Moines, which is the state's largest city. There had been a loss of 16 private practice dentists, which was offset by substantial net gains for some of Des Moines' surrounding communities (i.e., West Des Moines [west], Ankeny [north], and Pleasant Hill [east]). Likewise, although Iowa City had lost 8 private practice dentists, this number was counterbalanced with gains by Coralville and North Liberty, which are west and north of Iowa City, respectively.

Overall, 43% of Iowa communities showed a net loss in the number of private practice dentists.

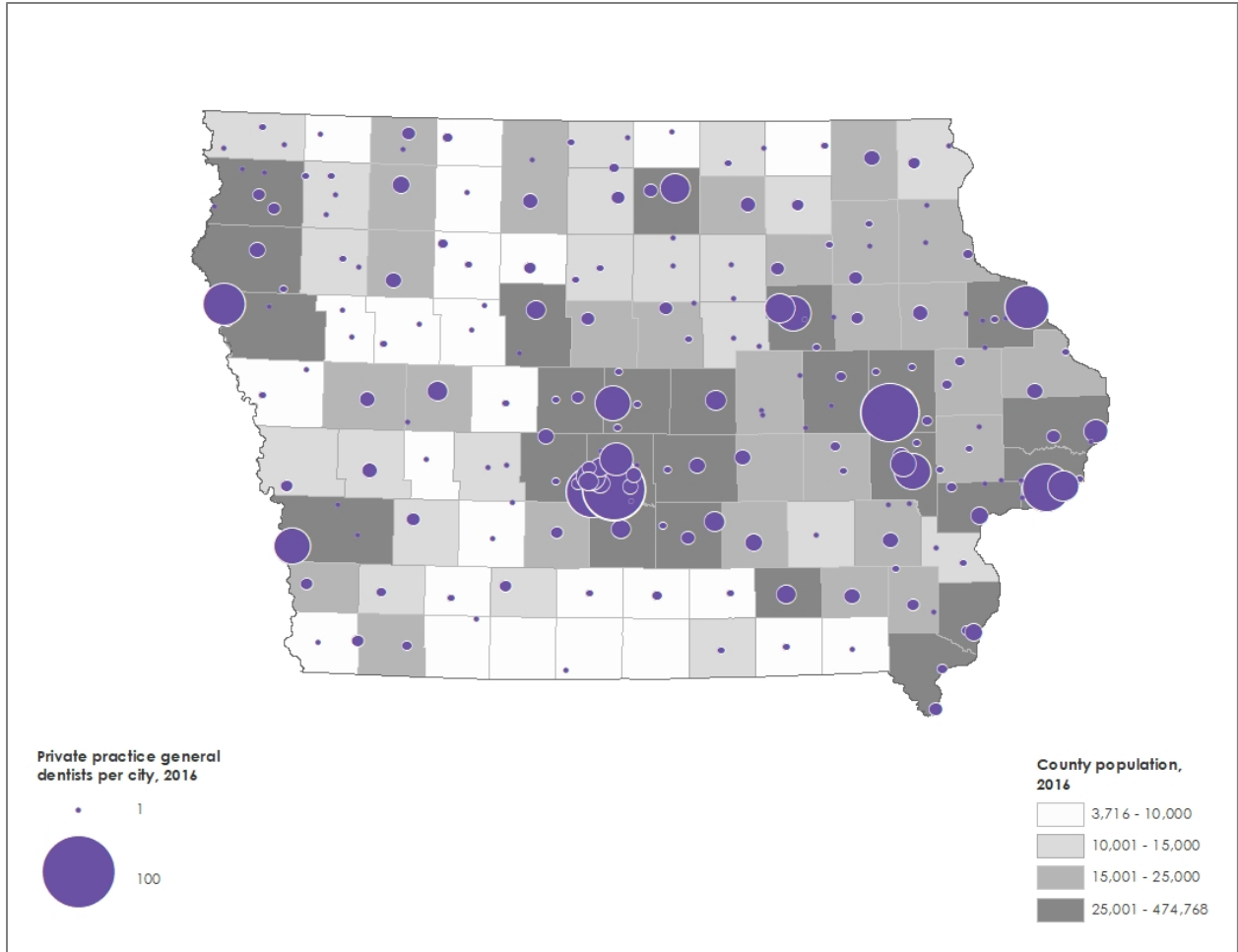


Figure 11. Location of Iowa private practice general dentists, 2016

Since almost 80% of private practice dentists are generalists, it is not surprising that this figure is quite similar to Figure 9 (all private practice dentists), especially in more rural areas of the state.

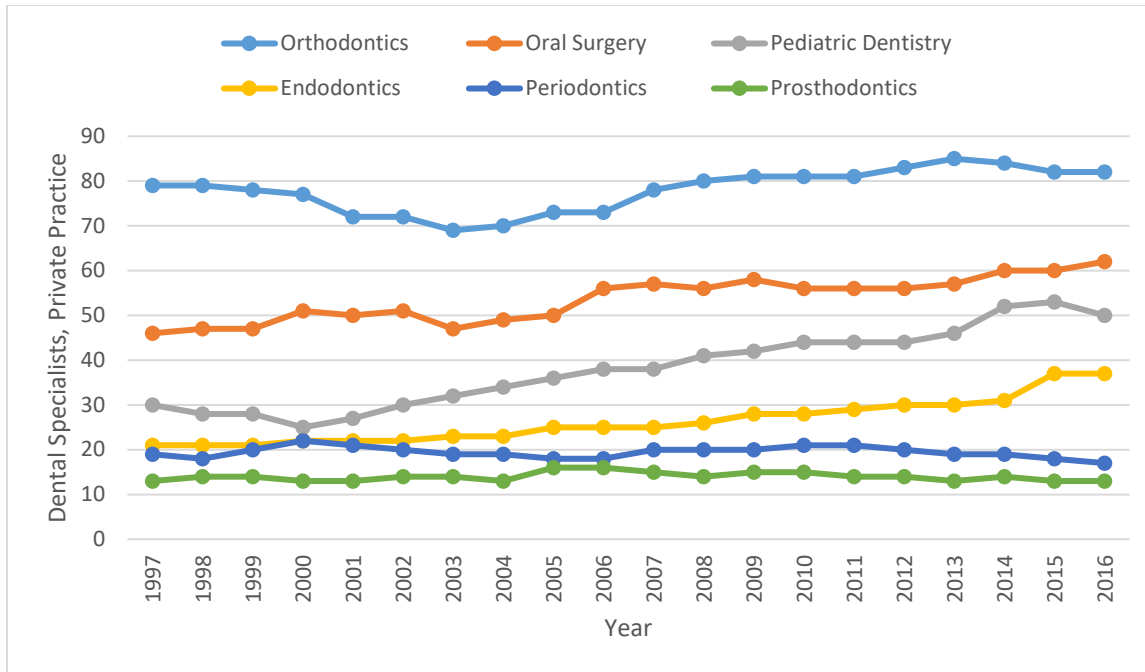


Figure 12. Number of Iowa dental specialists in private practice, 1997-2016

In 2016, there were 261 Iowa dental specialists in private practice, a 25.4% increase since 1997.

Orthodontics started and ended with nearly identical numbers, but their numbers dipped in early to mid-2000s.

The number of oral and maxillofacial surgeons had a slow, steady increase during the 20 years from 46 to 62.

The most rapid rise in number of any of the clinical specialties during this time period was for pediatric dentistry, which doubled in size from 2000 to 2016.

Likewise, there was almost a doubling in the number of endodontists, from 21 to 37.

The number of periodontists and prosthodontists remained stable number throughout, with a slightly greater number of periodontists during this time frame.

Figures 13 through 18 display the location for 6 clinical dental specialists (endodontists, oral surgeons, orthodontists, pediatric dentists, periodontists, and prosthodontists) in private practice during 3 time periods (1997, 2006, and 2016).

The legend on the left of each map indicates the number of private practice specialists by city.

The legend on the right provides, in quintiles, the number of general dentists per county population. Note that the last 2 categories for 2016 differ from 1997 and 2006.

For 2016, the city of West Des Moines had the most private practice endodontists, oral surgeons, pediatric dentists, and prosthodontists. Cedar Rapids had the most private practice orthodontists and periodontists.

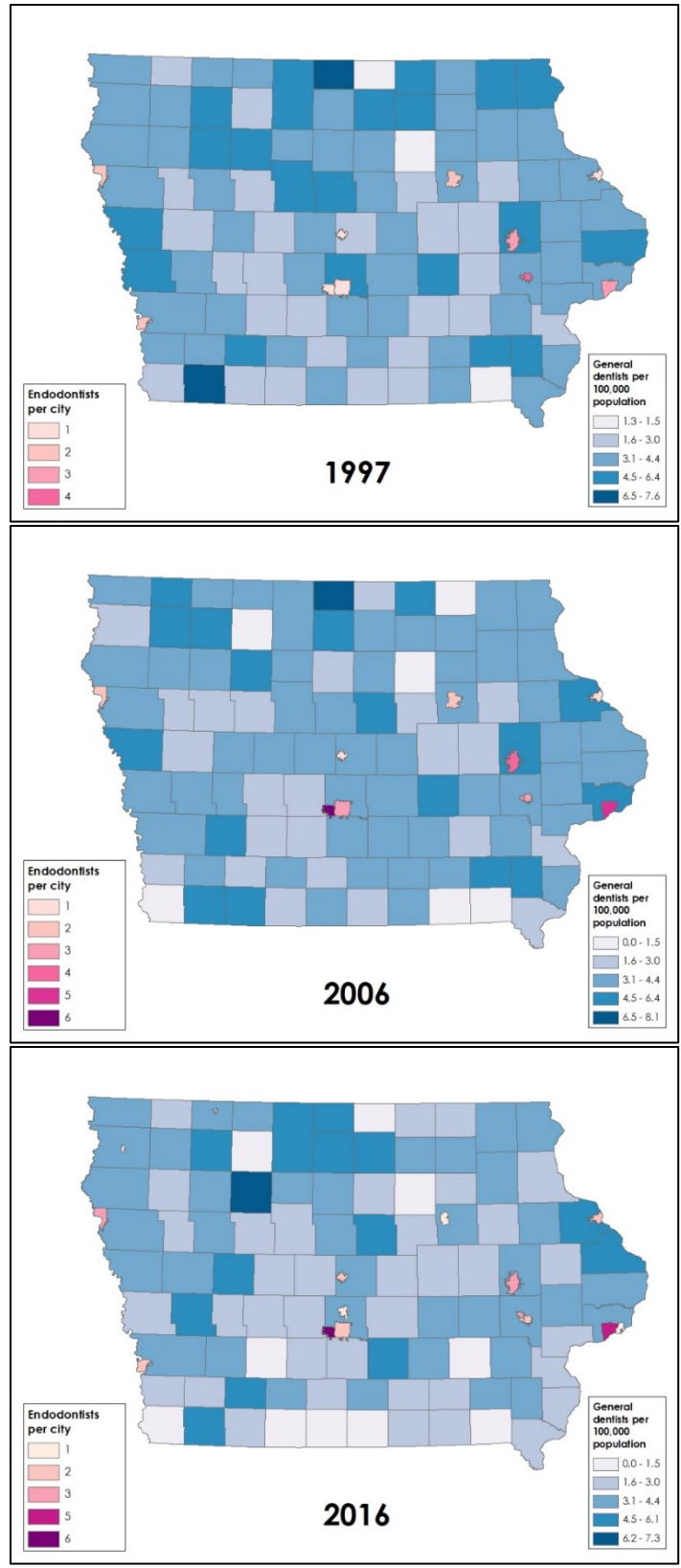


Figure 13. Location of private practice endodontists per city, 1997, 2006, and 2016

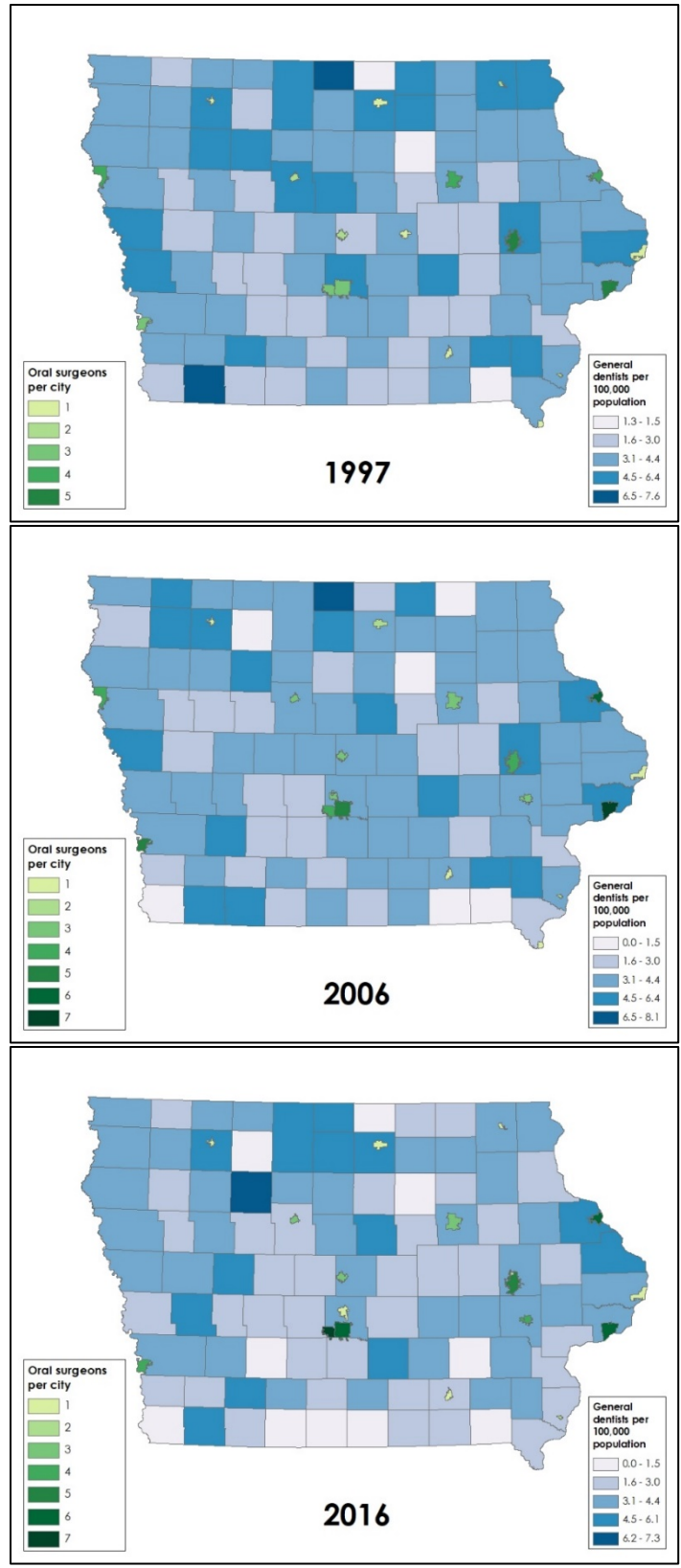


Figure 14. Location of private practice oral surgeons per city, 1997, 2006, and 2016

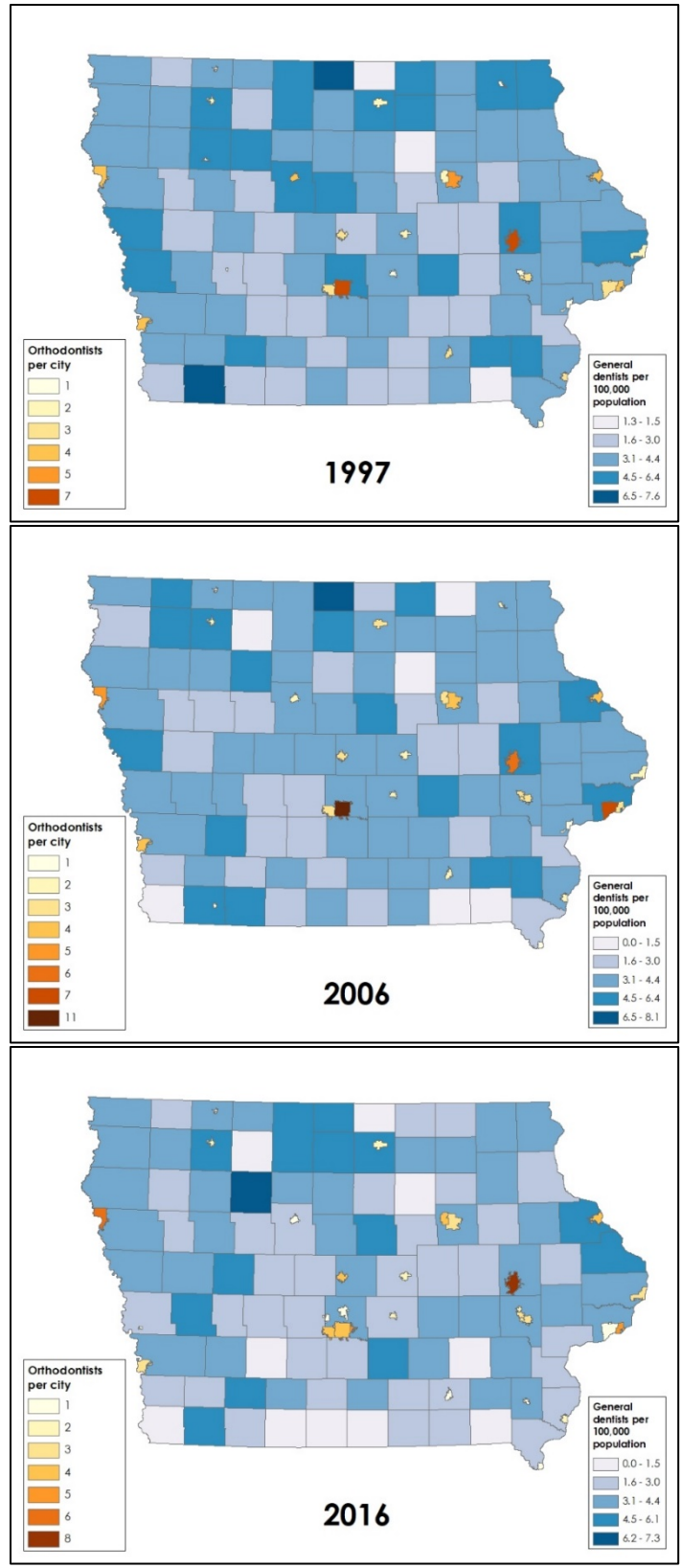


Figure 15. Location of private practice orthodontists per city, 1997, 2006, and 2016

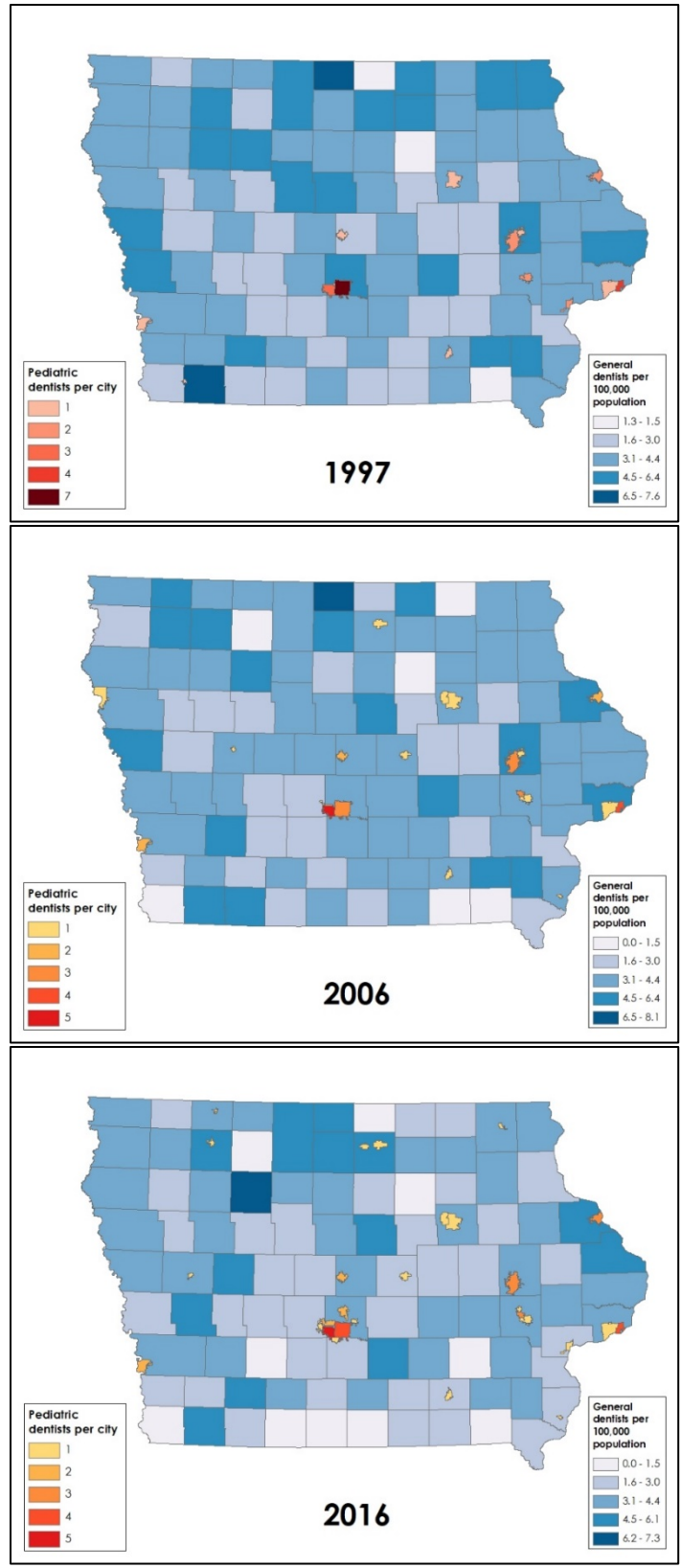


Figure 16. Location of private practice pediatric dentists per city, 1997, 2006, and 2016

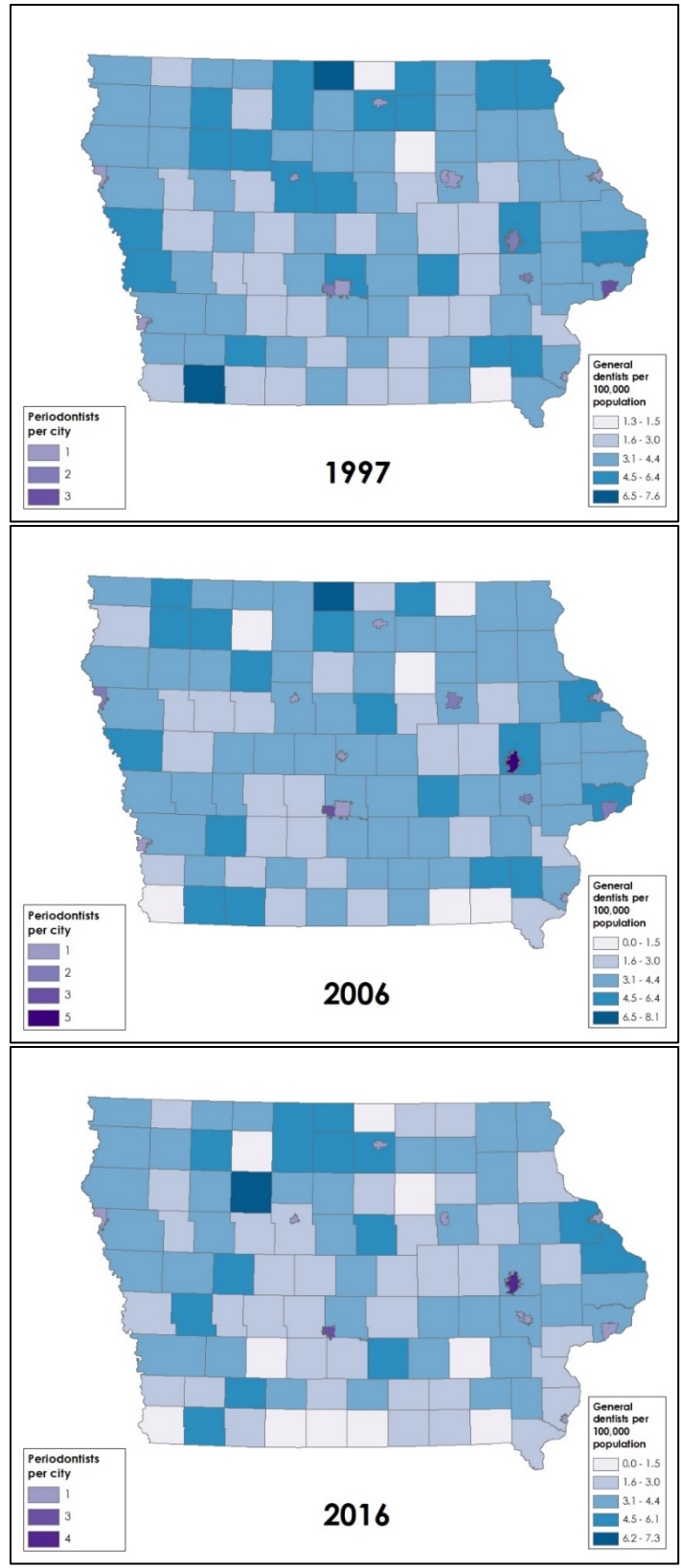


Figure 17. Location of private practice periodontists per city, 1997, 2006, and 2016

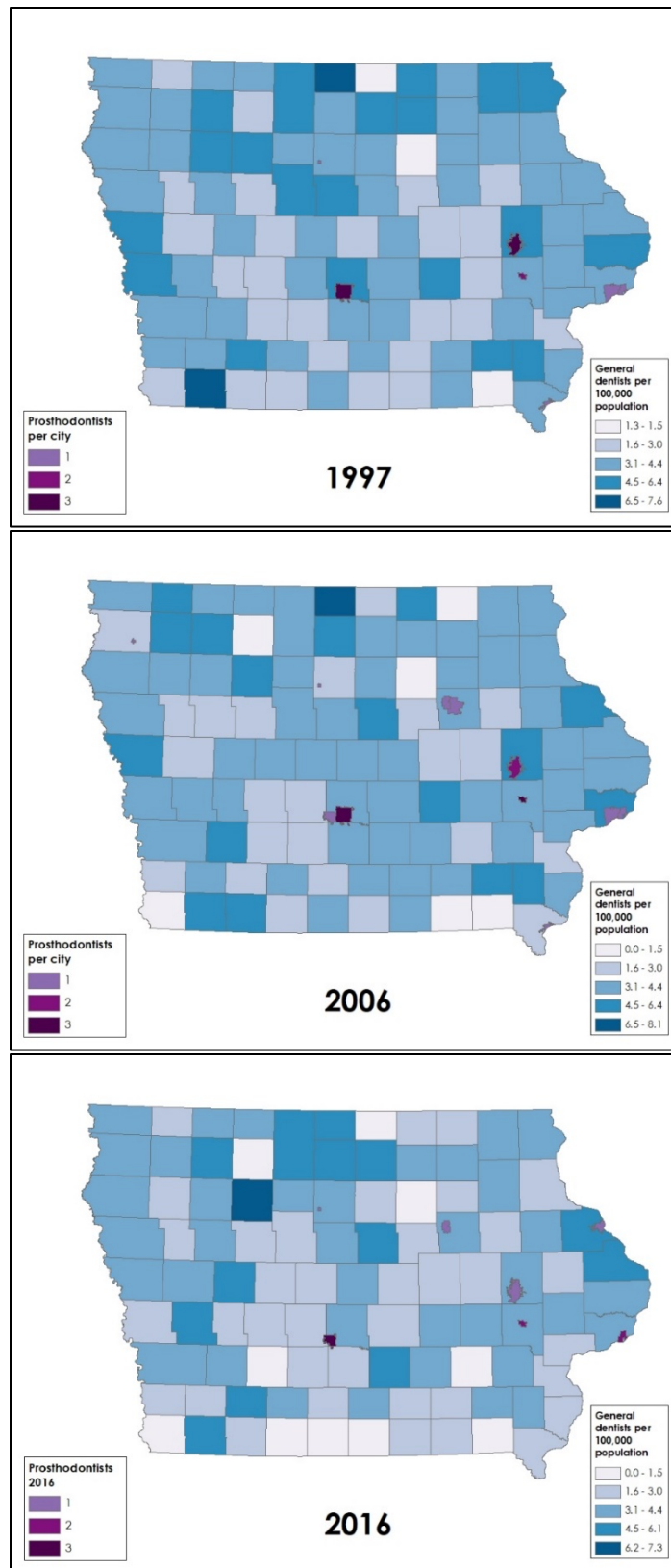


Figure 18. Location of private practice prosthodontists per city, 1997, 2006, and 2016

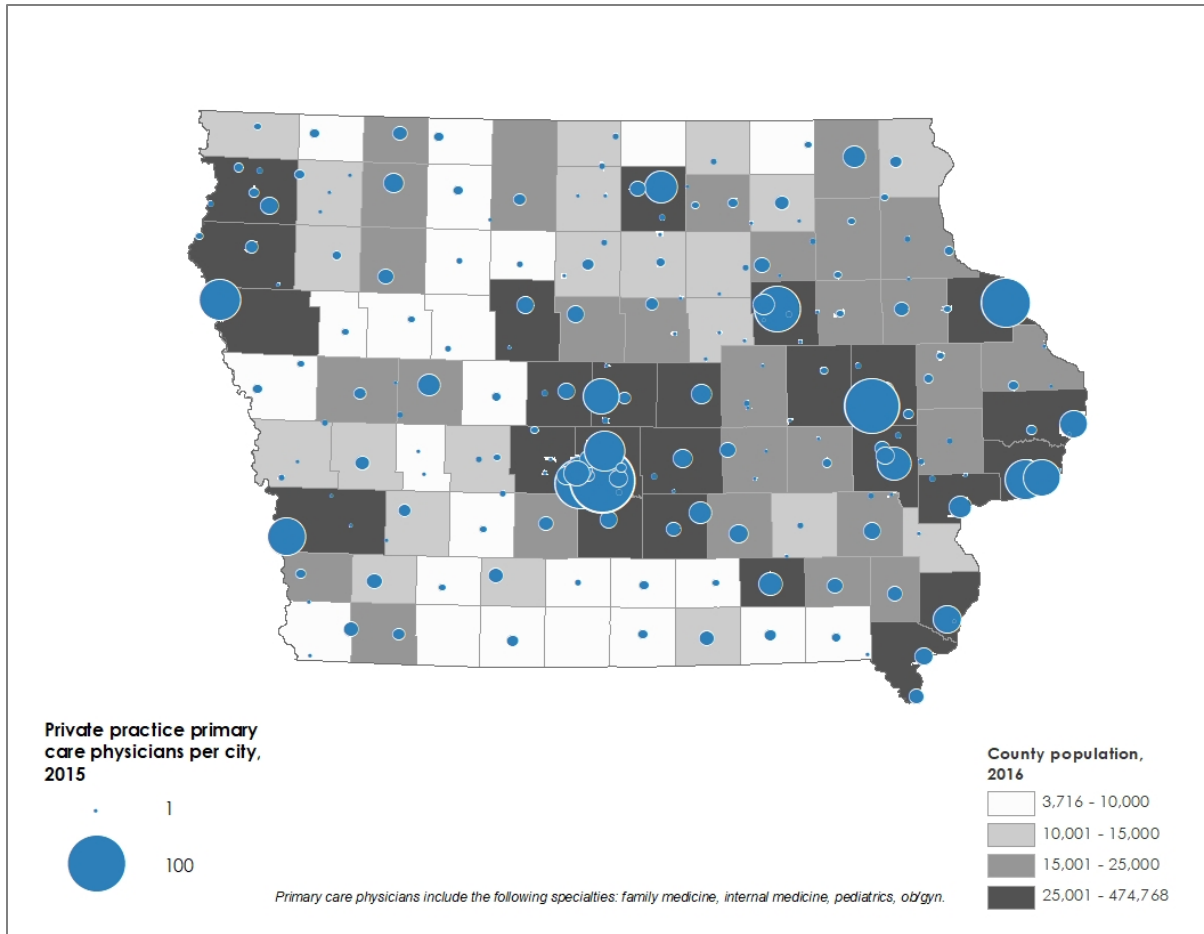


Figure 19. Location of Iowa primary care physicians, 2015

The size of the blue circle indicates the relative cadre of primary care physicians (i.e., family medicine, internal medicine, pediatrics, and obstetrics/gynecology) for that community. Each county is categorized into 1 of 4 groups based on the size of the population. The darker the shade of the county, the more heavily populated the county at that time period.

Refer to Figure 9 to observe similarities and differences between the location of primary care physicians and private practice dentists for approximately the same time period.

N.B.: The authors purchased the physician data files for years ending in 0 and 5. Thus, this figure is out of sync with the 2016 data, but annual changes are very small for any of the tracking systems.

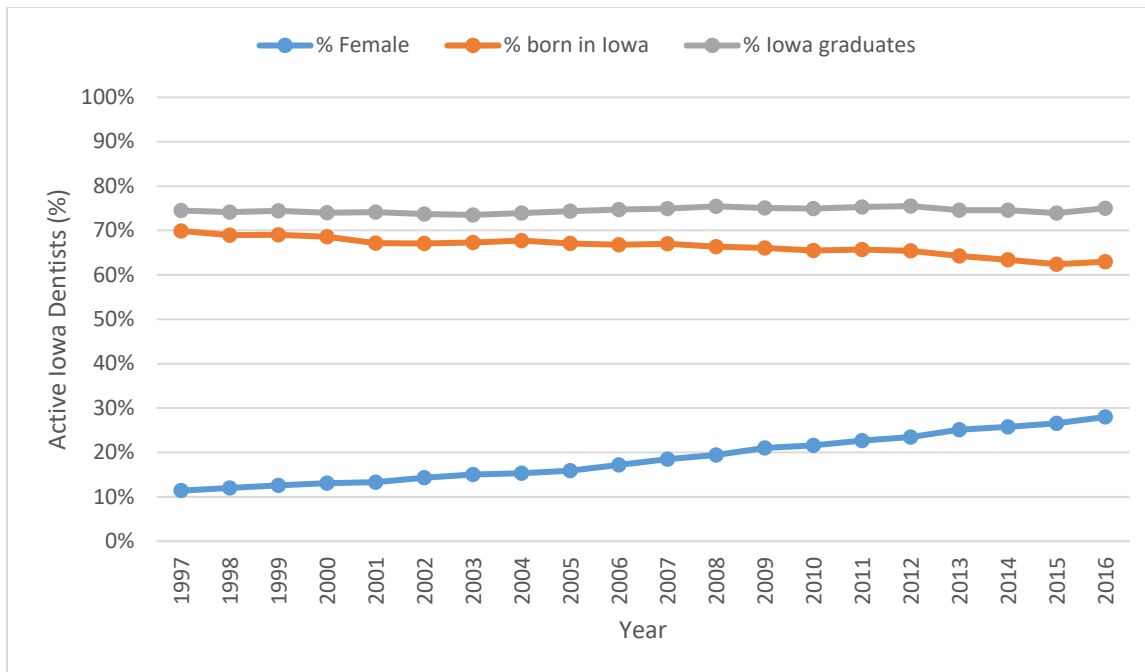


Figure 20. Percent of active Iowa dentists, by sex, birth state, and dental school attended, 1997-2016

The percent of female active dentists increased from 11% in 1997 to 28% in 2016.

There was almost no variation (74-75%) in the percent of University of Iowa graduates during this time.

There was a gradual decrease in the percent of active Iowa dentists who were born in the state. In 1997, 70% were Iowa native; this percent decreased to 62-63% by 2015-2016.

Dentist Workforce Inflow and Outflow

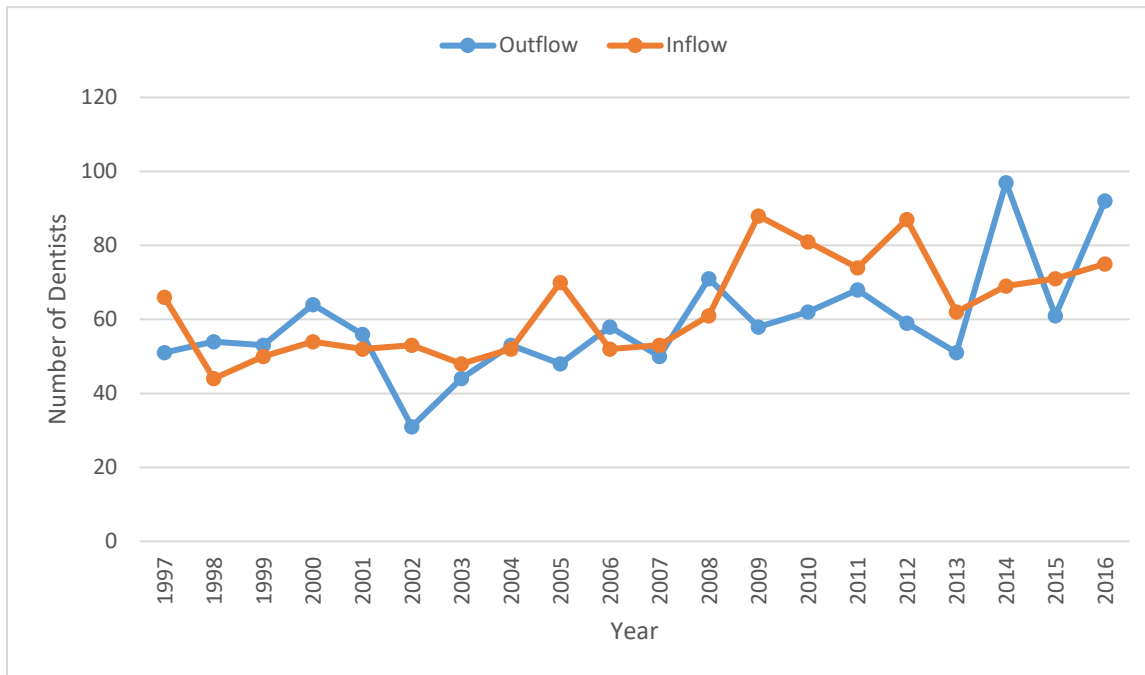


Figure 21. Iowa dentist workforce inflow and outflow, 1997-2016

In some years, more dentists entered the state for the first time than exited through retirement, relocation to another state, or leaving practice via a different route. Such was the case for 2009 through 2013. More recently, outflow has generally exceeded inflow, primarily due to the natural retirement age for the large wave of dentists who graduated in the 1970s.

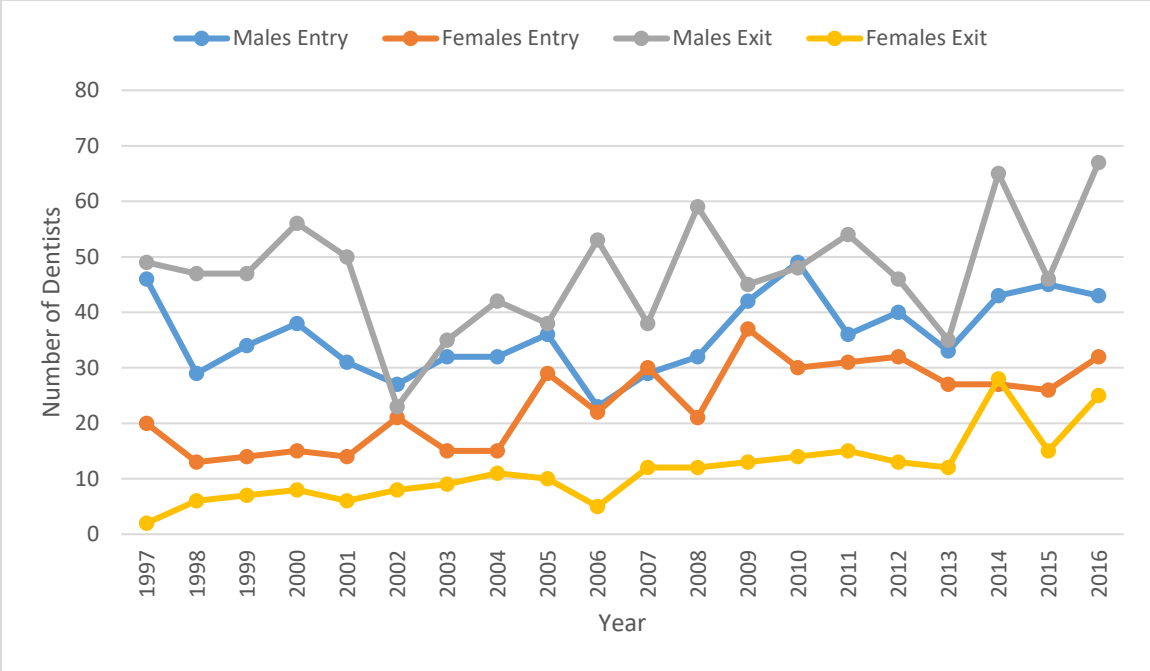
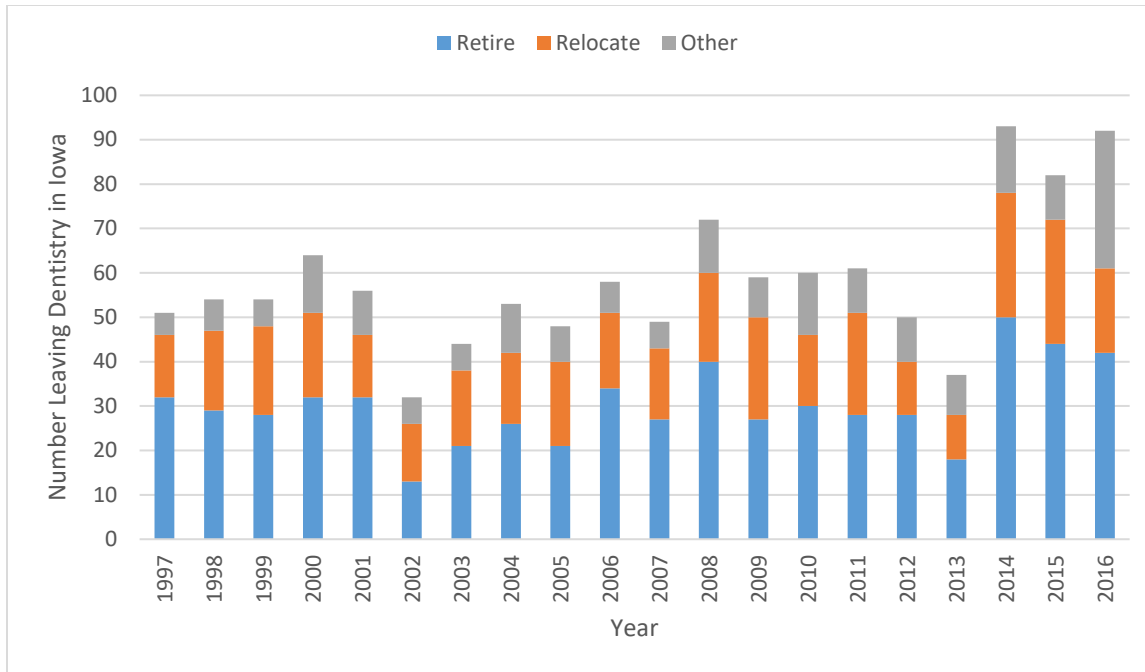


Figure 22. Inflow and outflow for all Iowa dentists, by sex, 1997-2016

There appear to be different patterns for the inflow and outflow of dentists according to sex. Male dentists had a greater likelihood of exiting the tracking system than entering. That is, for all years except one (2002) the outflow of male dentists exceeded the inflow. The opposite is true about female dentists. With the exception of 2014, there have been more female dentists entering the tracking system than leaving it.



“Other” includes death, health reasons, advanced training, inactivity, license lost, and military service

Figure 23. Reasons for dentist outflow, Iowa, 1997-2016

For every year during this time period the number of retirees exceeded either those who relocated to another state or left practice because of other reasons. Following an ebb in the outflow in 2012 and 2013, there has been a substantial increase in the outflow from 2014 through 2016. Speculation suggests that this upswing in dentists exiting the system is due, in part, to a larger than average group of dentists who were at or beyond “normal” retirement age and took advantage of a good economy to exit the system subsequent to a major recession several years prior. Interestingly, 2016 saw an unusually large number of dentists (17) who became “inactive”.

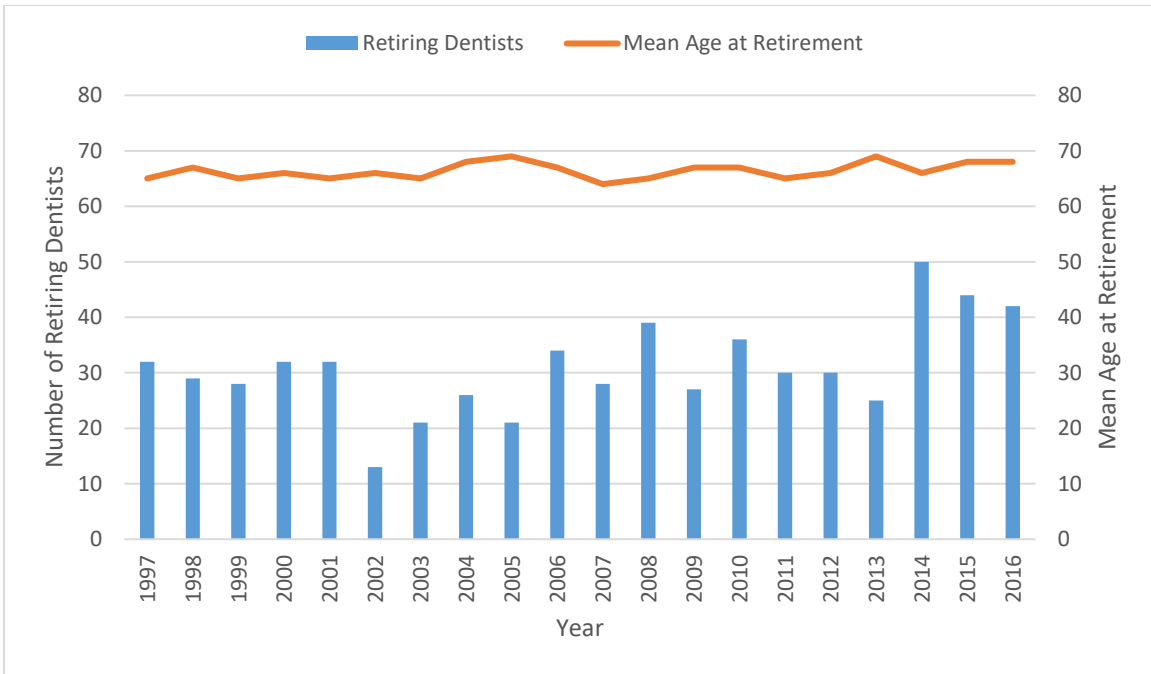


Figure 24. Number of retiring Iowa dentists and mean age at retirement, 1997-2016

The number of retirees varied throughout the 20 years. The lowest number was 13 in 2002, which immediately followed the dot-com economic bubble. The greatest number of retirees in one year was 51 in 2014, including several University of Iowa faculty who received an early retirement incentive package.

Historically, dentists generally retire from the profession during their 60s. The range during this time period was from a low of 64 years in 2007 to a high of 69 years in 2005.

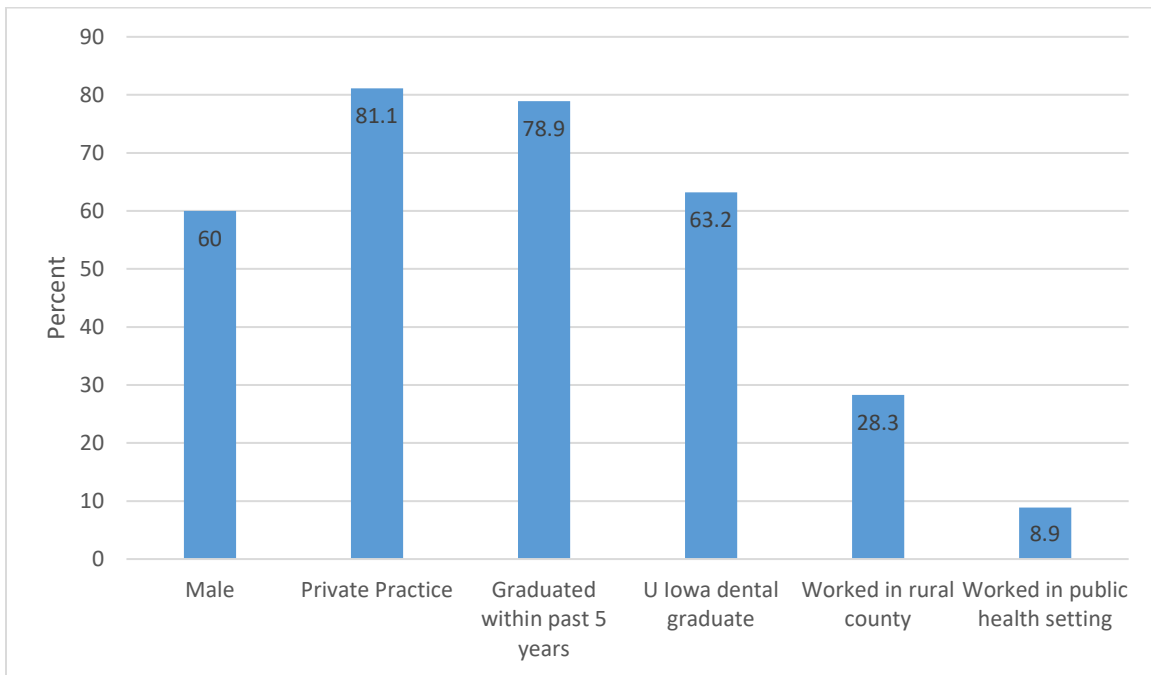


Figure 25. Characteristics of dentists entering (inflow) Iowa workforce, 1997-2016 (N=1,192)

Males made up 60% of the active new dentists in the state during this time period. This is a considerable drop from 1997, when new active dentists were overwhelmingly male.

The overall rate of private practitioners in the state was approximately 10 percentage points higher than the rate of private practice among new active dentists entering the workforce. Nearly 9% of new active dentists worked in a public health setting during their initial year.

Not surprisingly, nearly 80% of new active dentists graduated within the previous 5 years.

Sixty-three percent of new active dentists are University of Iowa College of Dentistry graduates. This rate is lower than the overall rate for all active practitioners. One possible reason for this lower rate may be that graduates from other dental schools who initially practice in Iowa may leave the state within a relatively short time. This finding requires further analysis.

Nearly three-quarters of new active dentists are working in urban counties. If these new dentists remain in urban settings for the duration of their practicing years, it will not bode well for dentist availability in rural areas of the state.

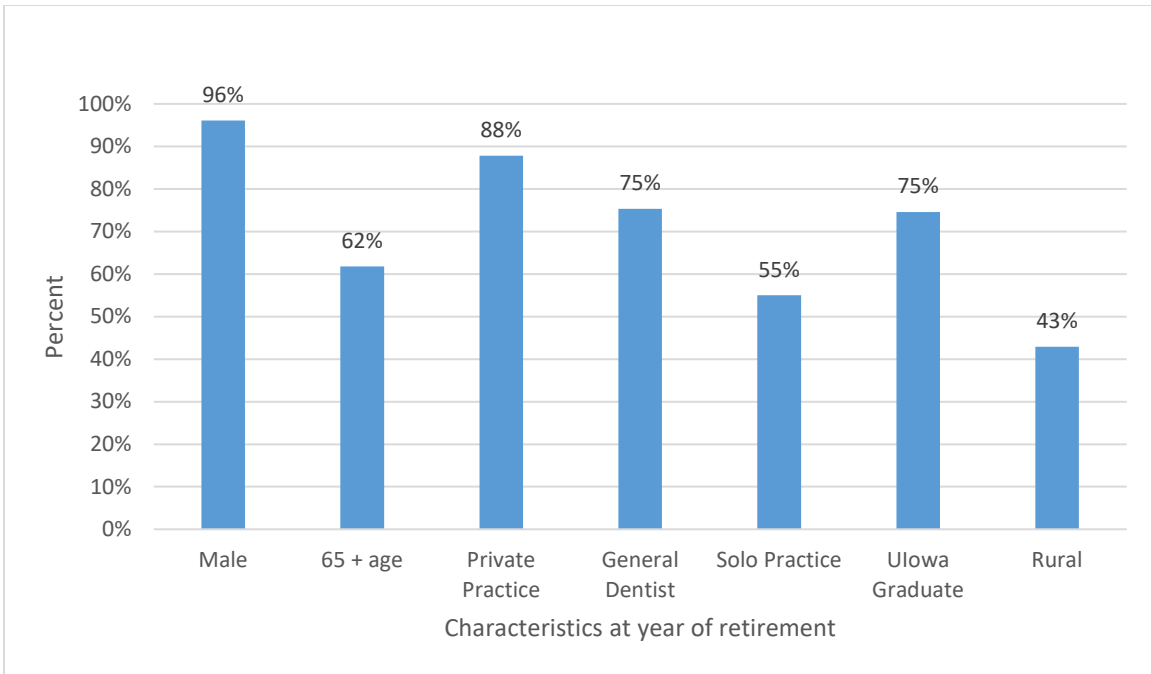
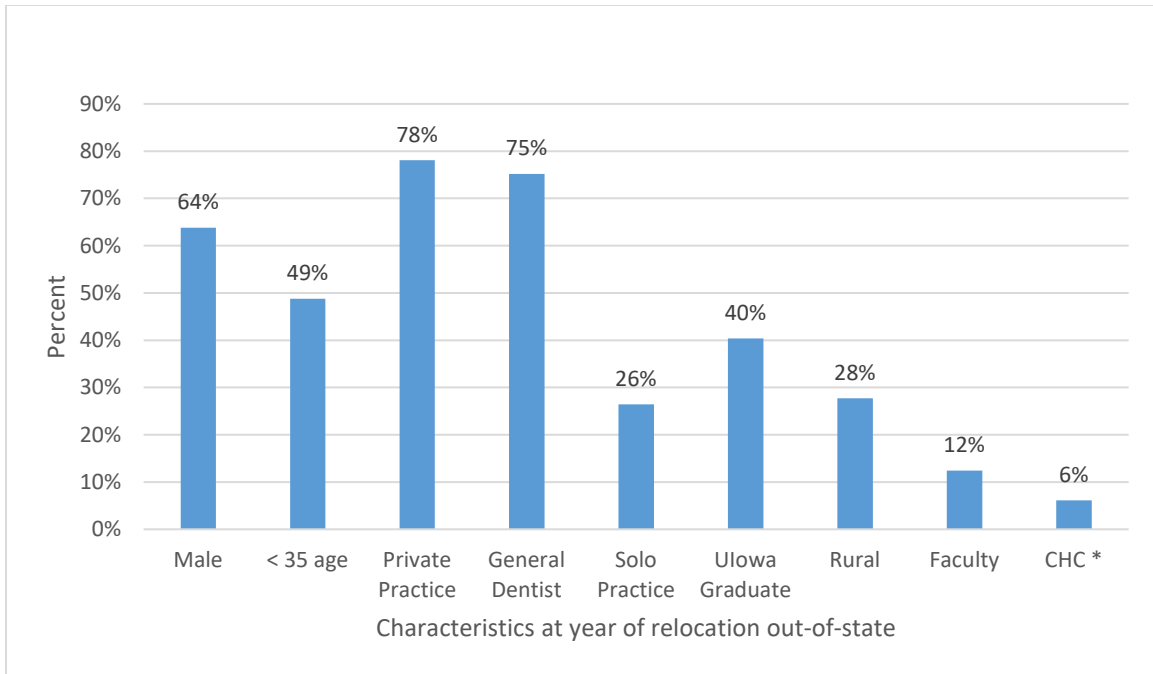


Figure 26. Characteristics of Iowa dentist retirees, 1997-2016 (N=615)

Since dental graduates from the 1960s through the 1980s were almost exclusively males, it is not surprising that 96% of retirees during this 20-year period were also males. The percentages for all the other categories are also fairly reflective of the working population.



* CHC: Community Health Center

Figure 27. Characteristics of Iowa dentists who relocated to another state, 1997-2016 (N=379)

The decision to relocate to another state is based on several variables, including personal, family, and professional issues. We provide these percentages, without interpretation, so that others might consider which, if any, of these characteristics are worthy of further analyses for studying dentist retention.

Workforce Trends

Sex

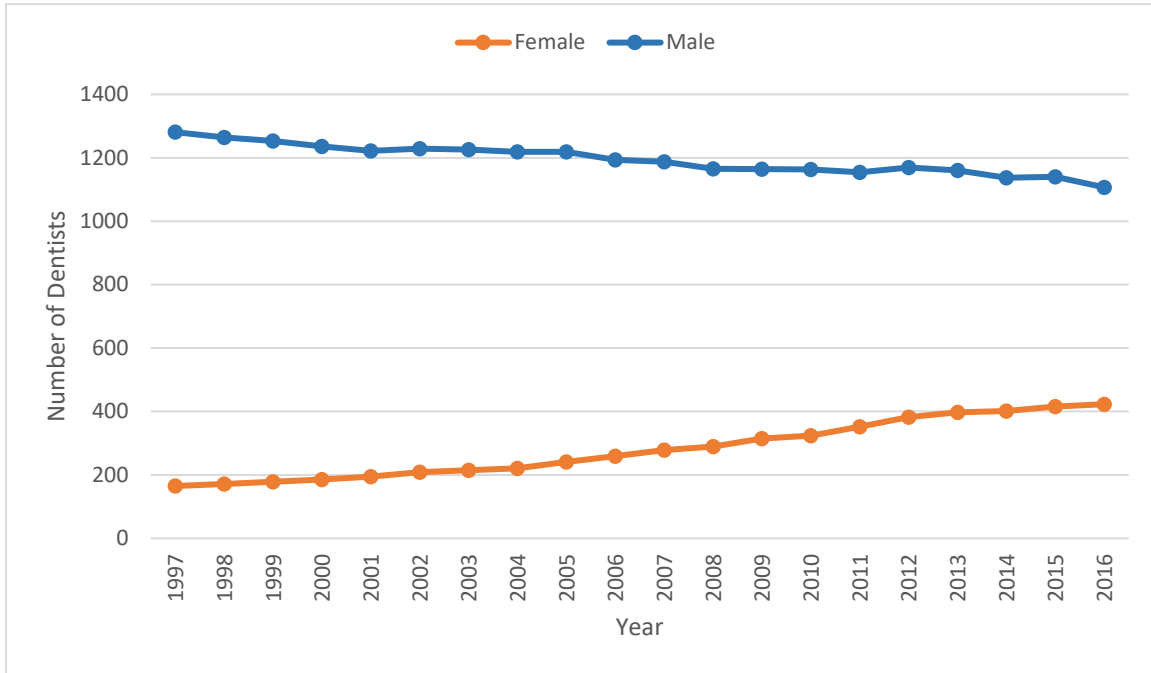


Figure 28. Active Iowa dentists, by sex, 1997-2016

In 1997, there were 165 active female dentists in Iowa, constituting 11.4% of all dentists. This number and percent have risen each year since. By 2016, there were 423 active female dentists, representing 27.6% of the total number of active dentists. This number will continue to rise during the immediate future for two reasons. First, the percent of University of Iowa incoming dental school classes have become more sex balanced. Second, the preponderance of dentists who will be retire in the short term will be male.

The increase in the number of women entering dentistry is reflected nationally, as well. In 2016, the percent of male and female enrollees in US dental schools was approximately equal.⁶

⁶ Wanchek T, Cook BJ, Valachovic RW. U.S. dental school applicants and enrollees, 2016 entering class. *J Dent Educ* 2017;81(11):1373-1382.

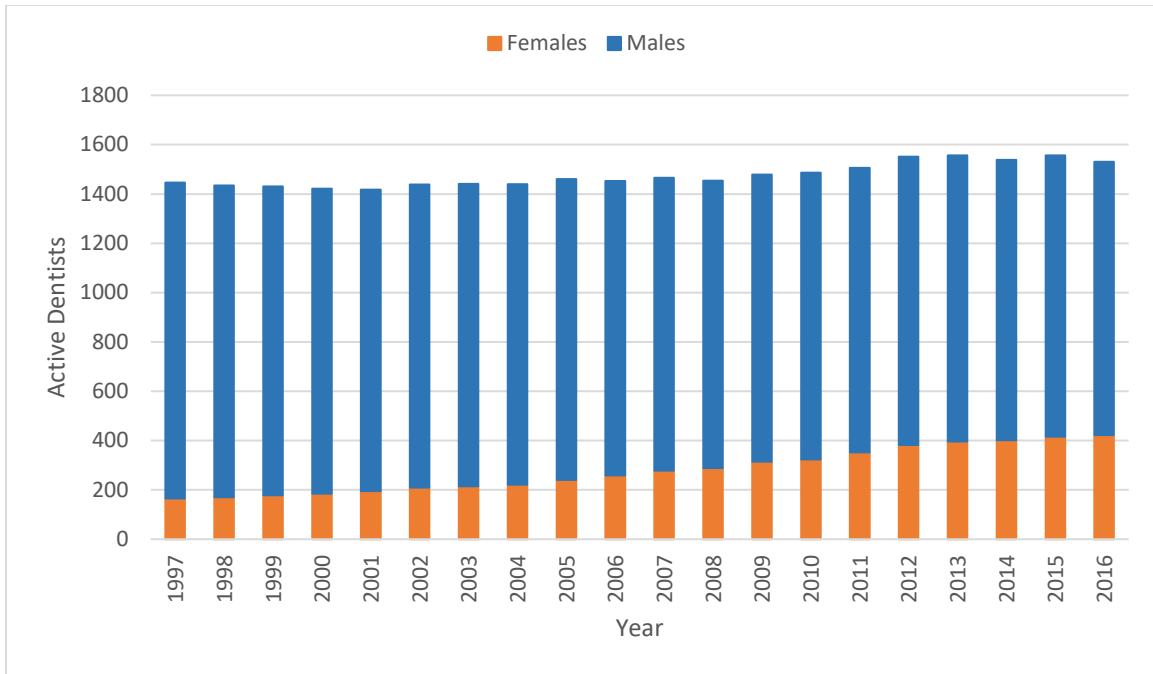


Figure 29. Active Iowa dentists, by sex, 1997-2016

Figure 29 is an alternate view of Figure 28.

The greatest number of active male dentists during this census occurred in 1997 (n=1,281), whereas, there were only 165 active female dentists that year. Conversely, the greatest number of female dentists (n=423) occurred in 2016, the same year in which there was the fewest number of active male dentists (n=1,107).

In total, the fewest number of total active dentists for this 20-year period was in 2001 (n=1,417) and the greatest number was in 2013 (n=1,557).

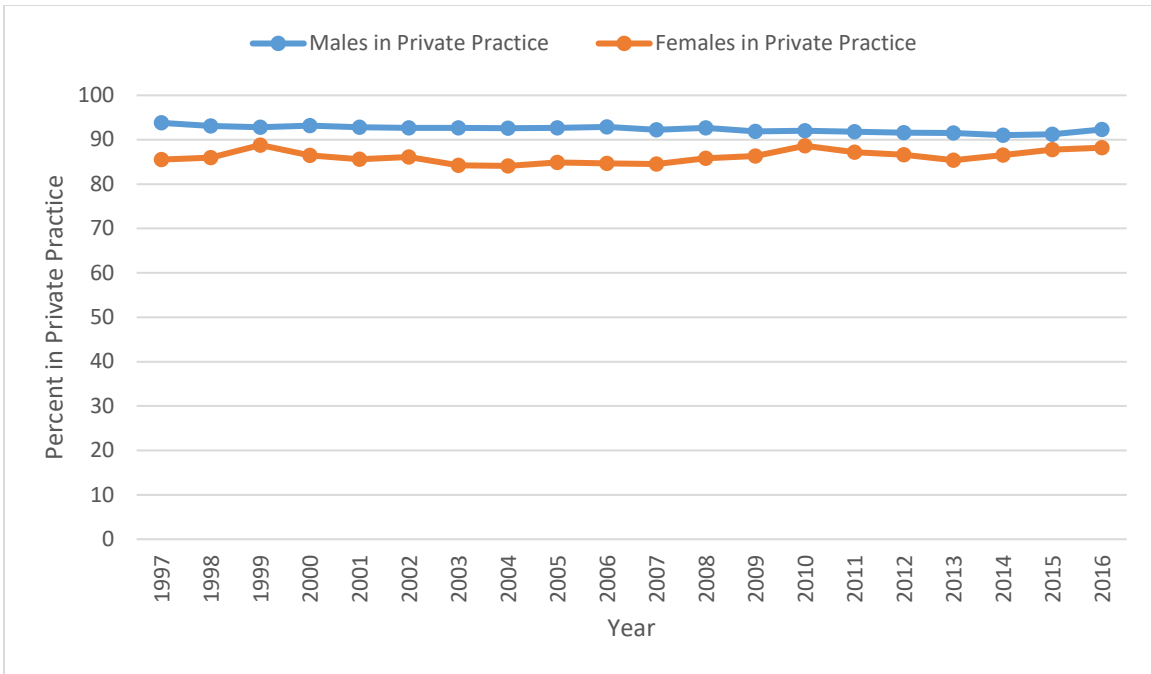


Figure 30. Percent of Iowa dentists in private practice, 1997-2016

The percent of male dentists who were in private practice for the period between 1997 through 2016 was approximately 91-94%. Although the overwhelming majority of female dentists also participated in private practice, the percent was slightly lower than their male colleagues, ranging from a low of 84% (2004) to a high of 89% (1999 and 2010).

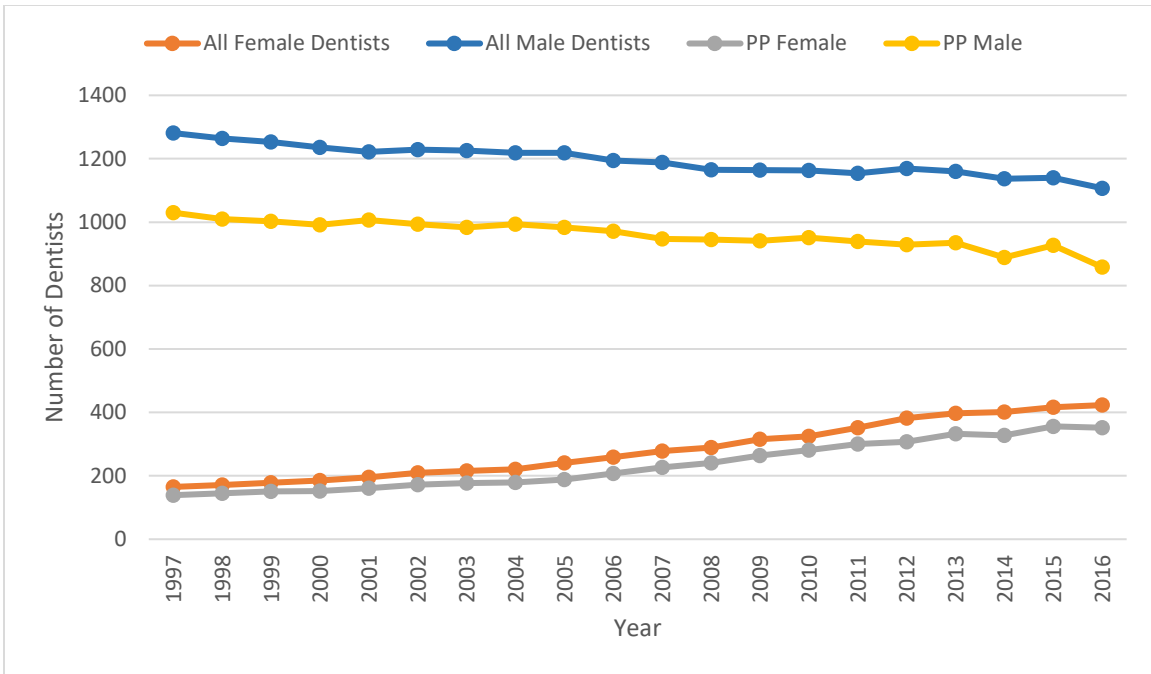


Figure 31. Active and private practice (PP) Iowa dentists, by sex, 1997-2016

The number of male dentists in private practice decreased from a high of 1,030 (1997) to 858 (2016). The ever-increasing number of female dentists in private practice ranged from 139 (1997) to 356 (2015). Thus, although female dentists made up only 11.9% of all private practice dentists in 1997, this percent had increased to 29.1% by 2016.

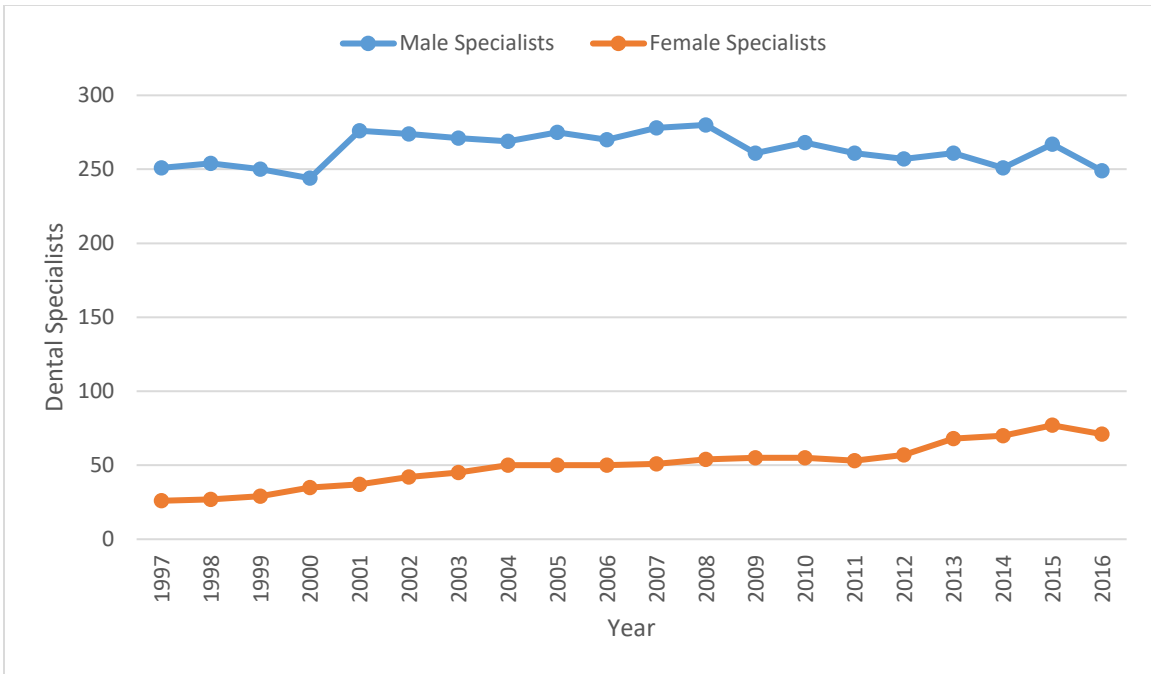


Figure 32. Number of Iowa dental specialists, by sex, 1997-2016

The total number of dental specialists in the state increased from 277 (1997) to 344 (2015), a 24.2% increase. The number of male dental specialists increased to a high of 280 (in 2008), but in recent years has reverted to about 250. By contrast, the number of female specialists steadily increased from 27 in 1997 to 77 in 2015.

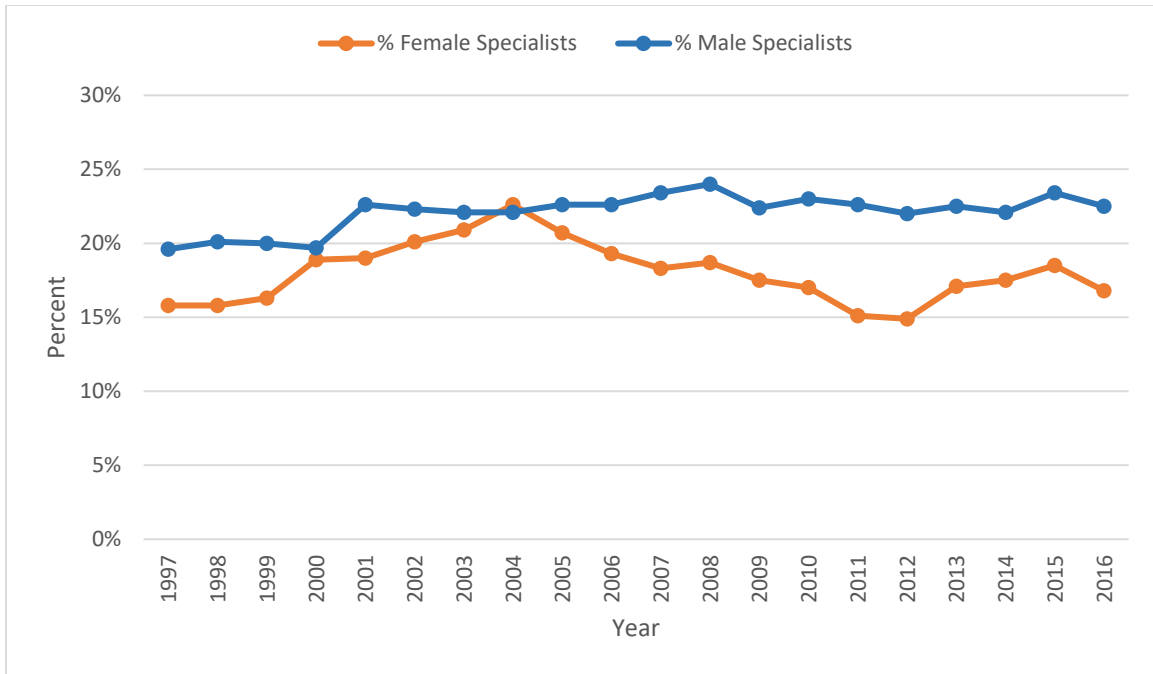


Figure 33. Percent of active Iowa dentists who are specialists, by sex, 1997-2016

The percent of active Iowa dentists who were specialists ranged from 19.6% (1997) to 24.0% (2008) for males and 15.8% (1997 and 1998) to 22.6% (2004) for females. 2004 was the only time when the percent of females who were specialists (as a percent of total active female dentists) exceeded males (22.6% versus 22.1%)

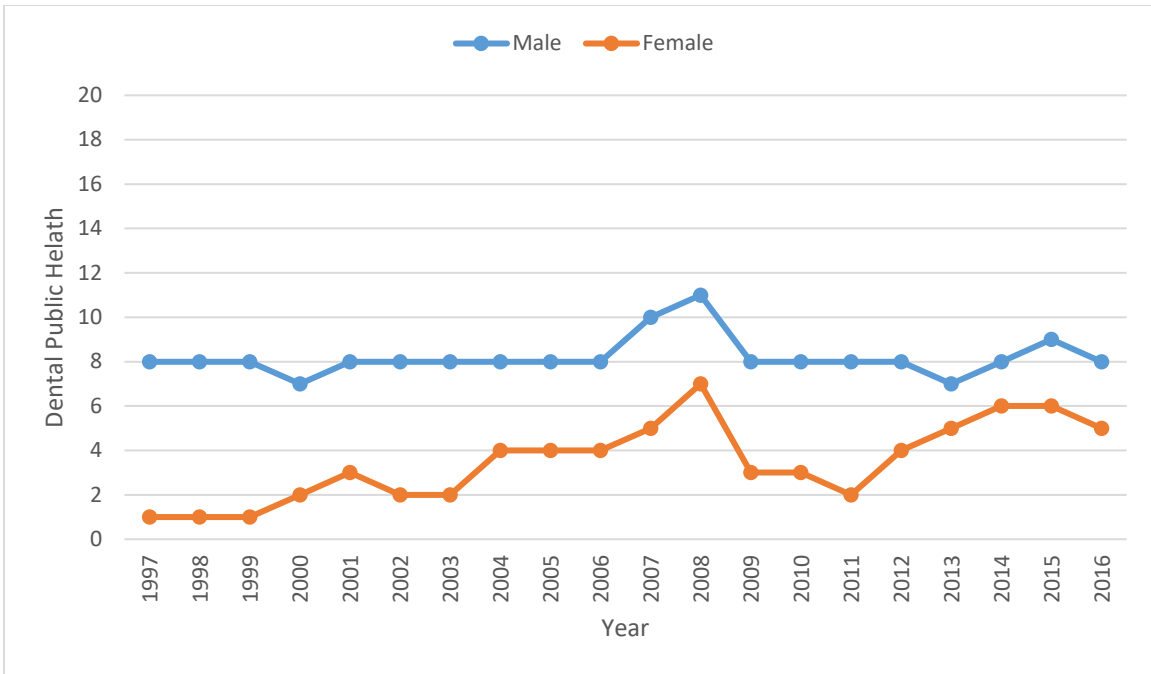


Figure 34. Dental public health dentists in Iowa, by sex, 1997-2016

Dental public health specialists are most likely employed either in educational institutions, government agencies, or organizational management. The numbers for each sex ranged as follows: for males, there was a high of 11 in 2008 and low of 7 in 2000 and 2013, and for females, there was a high of 7 in 2008 and low of 1 from 1997 through 1999.

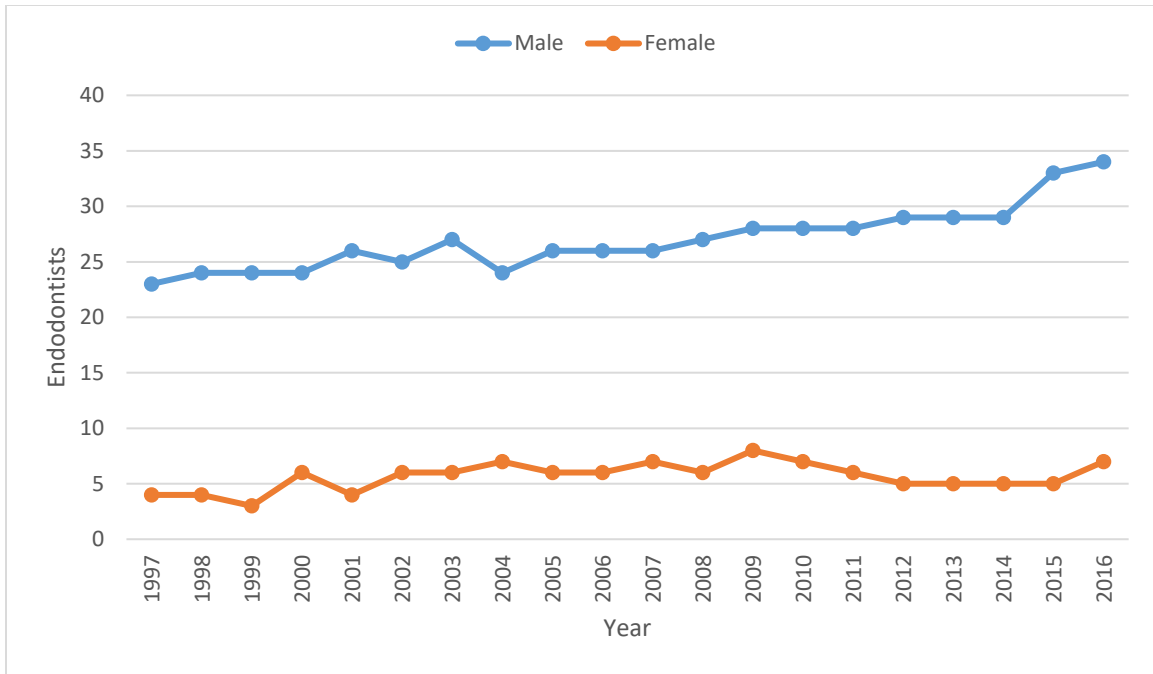


Figure 35. Endodontists in Iowa, by sex, 1997-2016

The number of male endodontists exceeded females by fivefold. The number of endodontists who were male ranged from a low of 23 in 1997 to a high of 34 in 2016. The number of female endodontists ranged from a low of 3 in 1999 to a high of 8 in 2009.

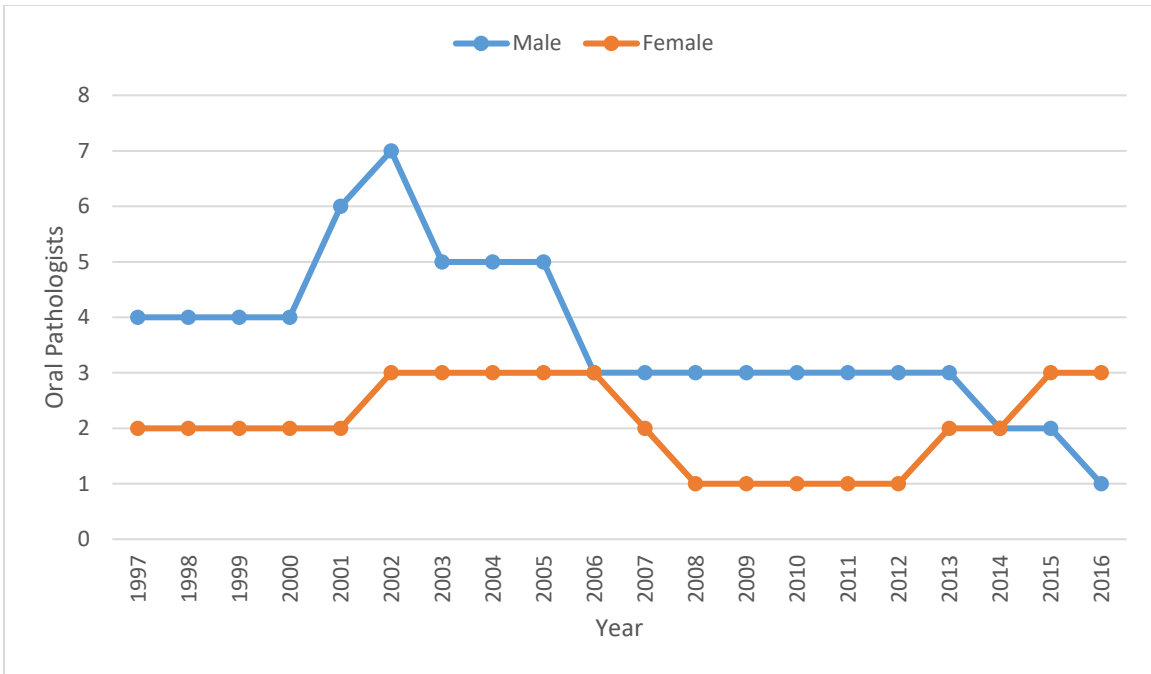


Figure 36. Oral and maxillofacial pathologists in Iowa, by sex, 1997-2016

Oral and maxillofacial pathologists general are generally employed in educational institutions or occasionally in hospitals. The number of male oral pathologists peaked at 7 in 2002 and dropped to a low of 1 in 2016. During this 20-year period, the number of female oral pathologists ranged from 1 to 3.

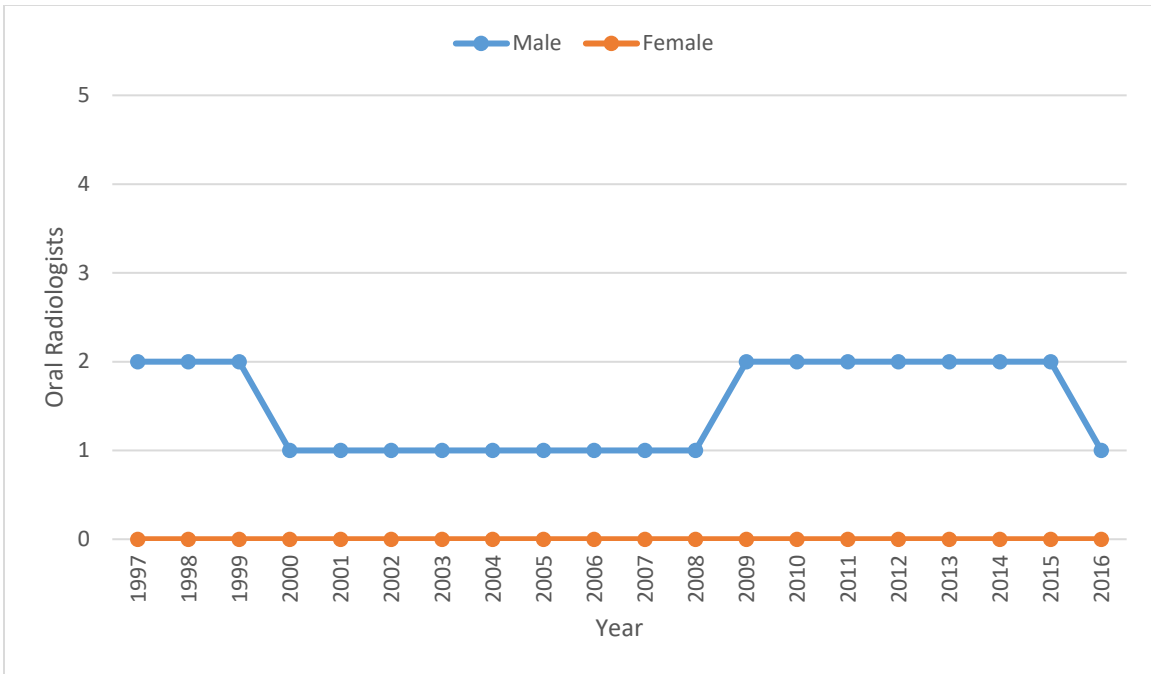


Figure 37. Oral and maxillofacial radiologists in Iowa, 1997-2016

Over this 20-year period, the number of oral radiologists working in the state remained low. There were at most 2 oral radiologists working at any given point during this time period, and all oral radiologists were males.

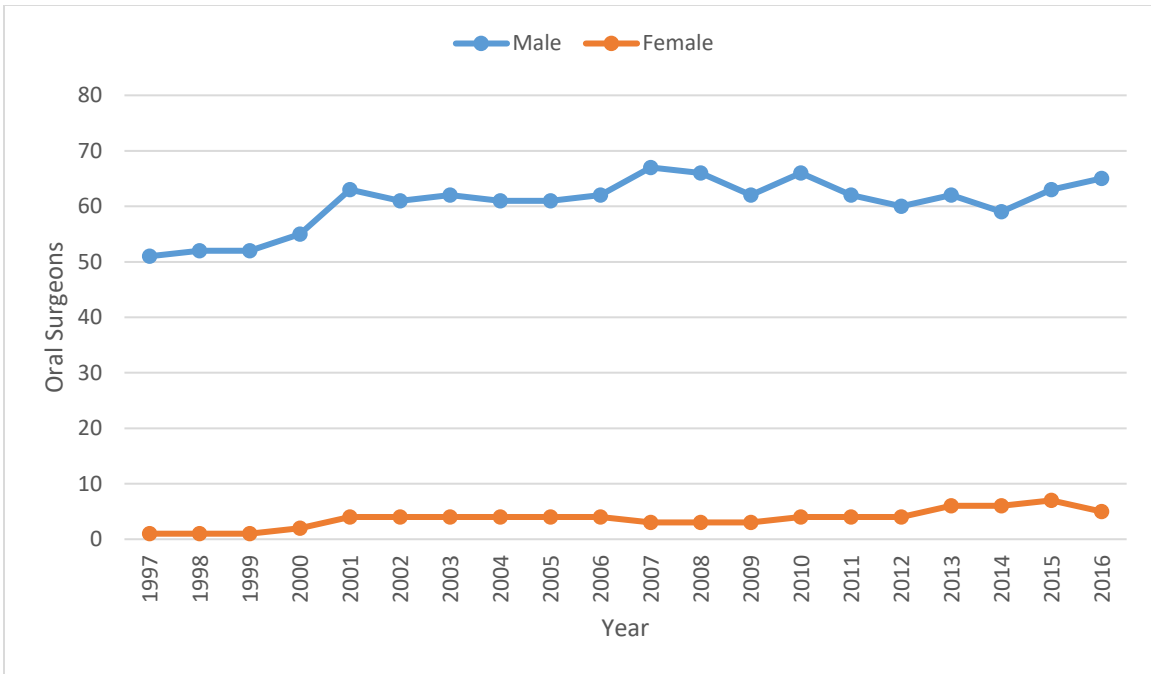


Figure 38. Oral and maxillofacial surgeons in Iowa, by sex, 1997-2016

There is a large disparity in the numbers of male and female oral and maxillofacial surgeons. The number of males ranged from a low of 51 in 1997 to a high of 67 in 2007. On the other hand, there was only 1 female oral surgeon for the first few years of this analysis, reaching a high of 7 in 2015.

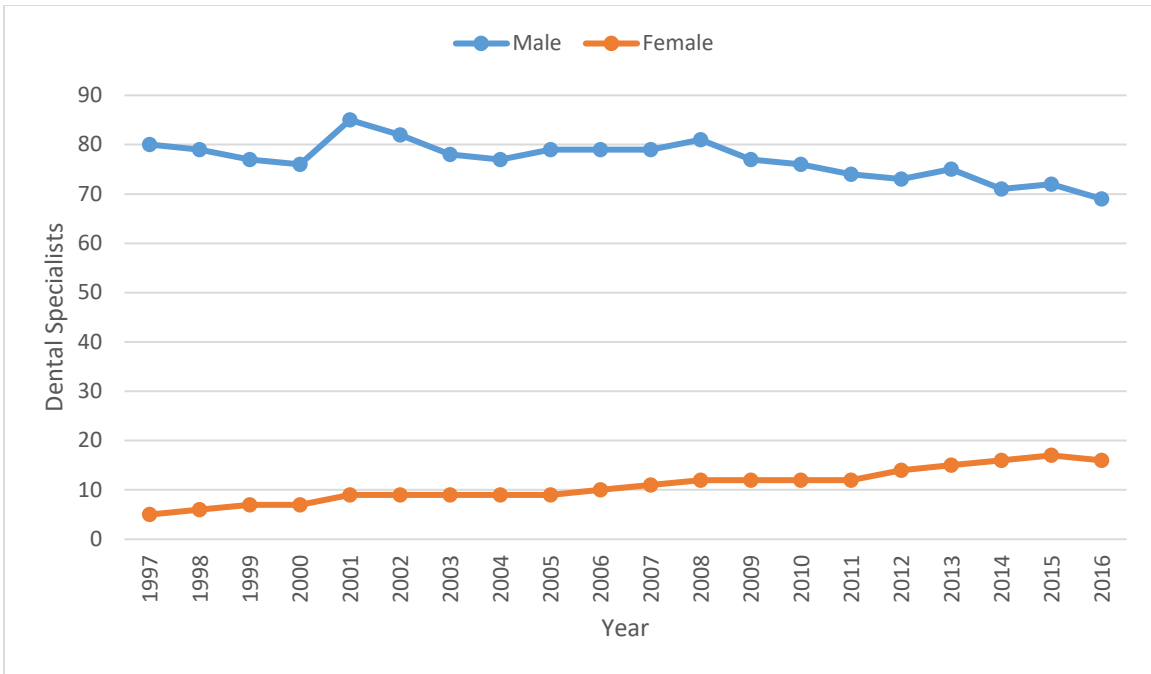


Figure 39. Orthodontists in Iowa, by sex, 1997-2016

The highest number of male orthodontists was 85 in 2001. However, there has been a slow, steady decline of male orthodontists during the past several years, ending with 69 in 2016.

There has been a threefold increase in the number of female orthodontists, from a low of 5 in 1997 to a high of 17 in 2015.

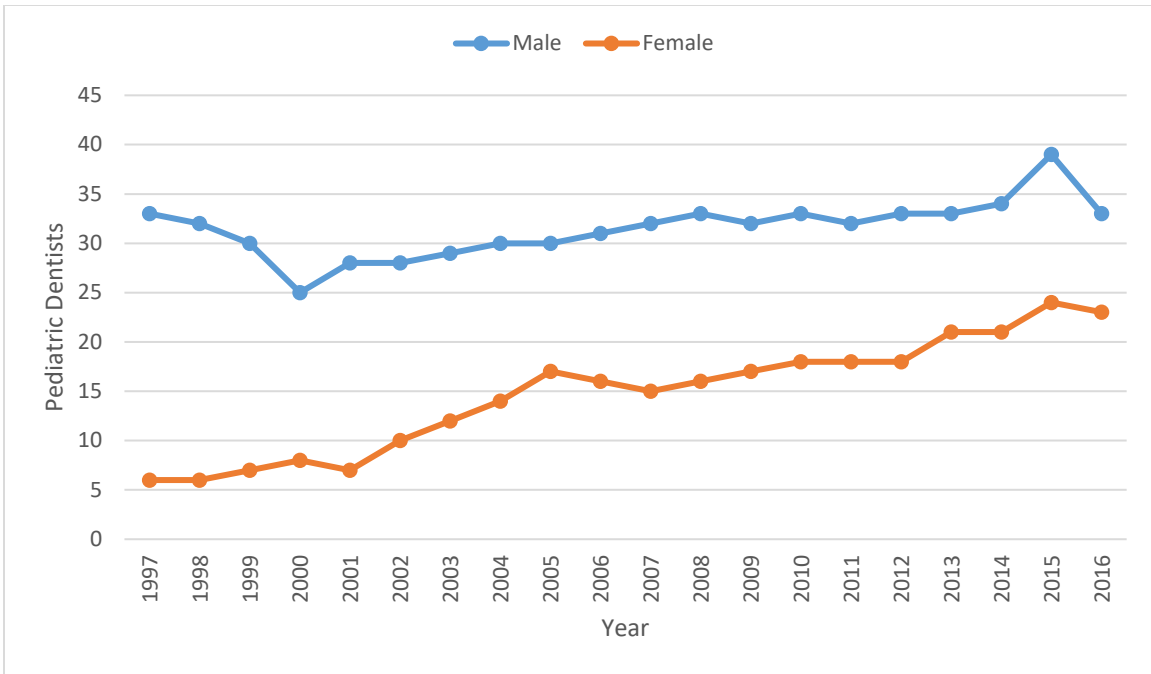


Figure 40. Pediatric dentists in Iowa, by sex, 1997-2016

As indicated in an earlier figure, the number of pediatric dentists had the greatest percentage increase of any of the dental specialties.

Initially, the number of males dipped from 33 in 1997 to bottom out at 25 in 2000. Since 2000, there has been a slow but steady increase in male pediatric dentists, peaking at 39 in 2015.

There was a fourfold increase in the number of female pediatric dentists, from 6 in 1997 to 24 in 2015.

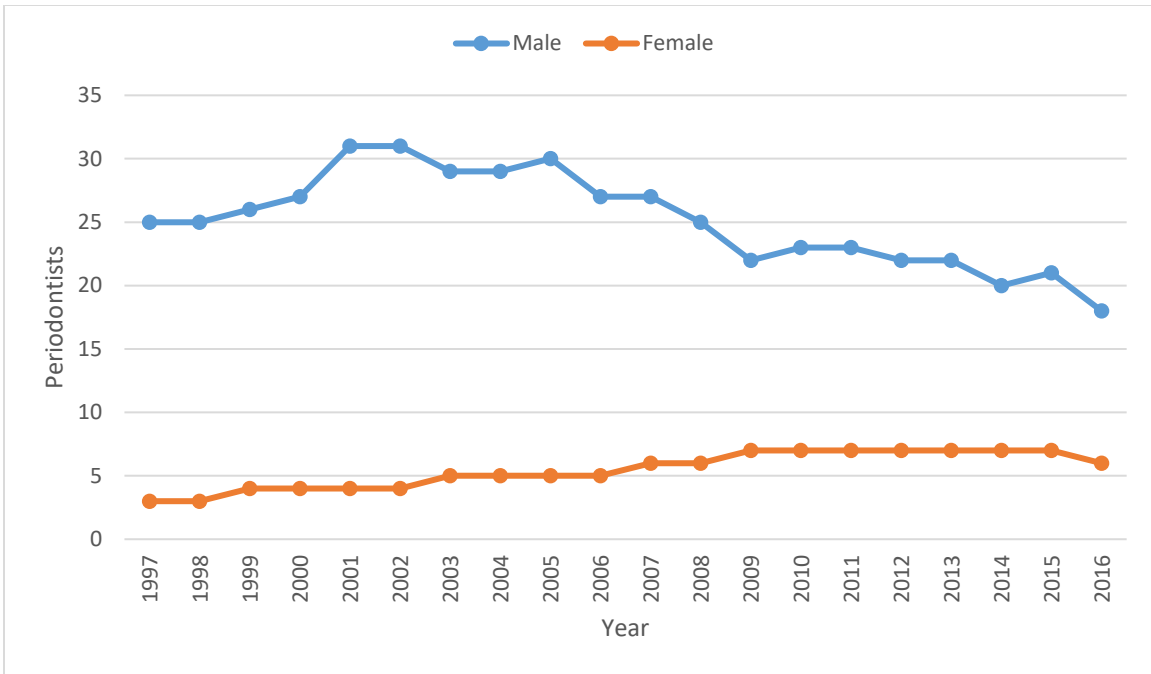


Figure 41. Periodontists in Iowa, by sex, 1997-2016

After an initial surge that saw a high of 31 in the number of male periodontists in 2001 and 2002, that number steadily declined to 18 in 2016. The number of female periodontists ranged from a low of 3 in 1997 and 1998 to a high of 7 in 2009 through 2015.

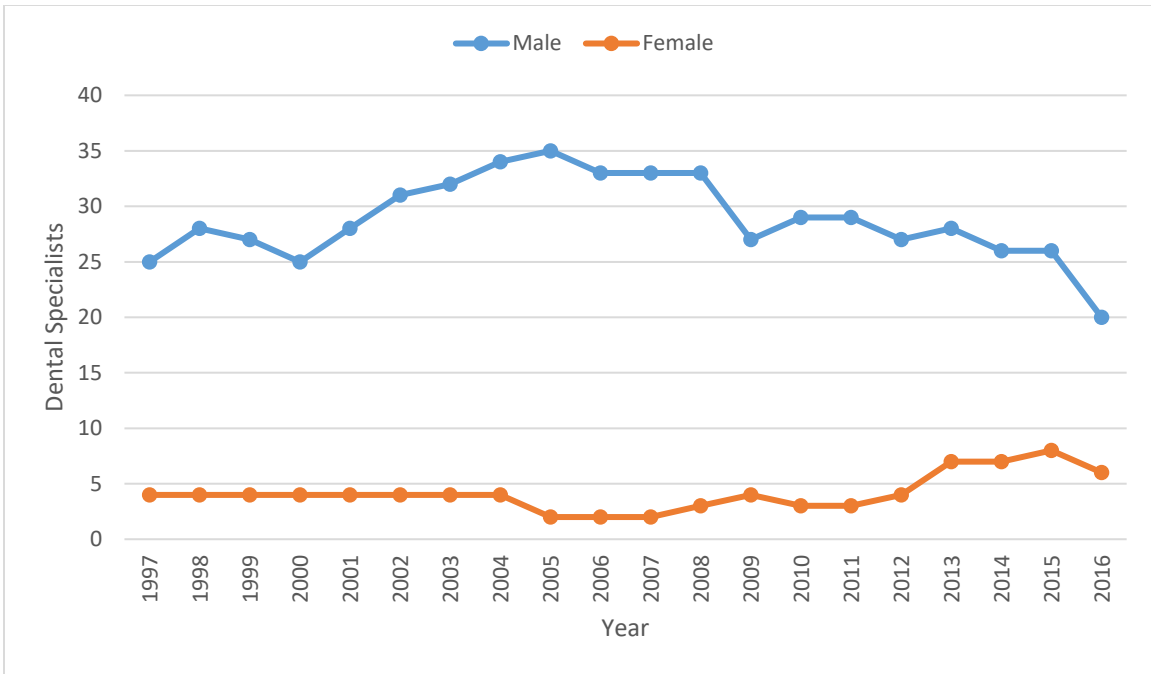
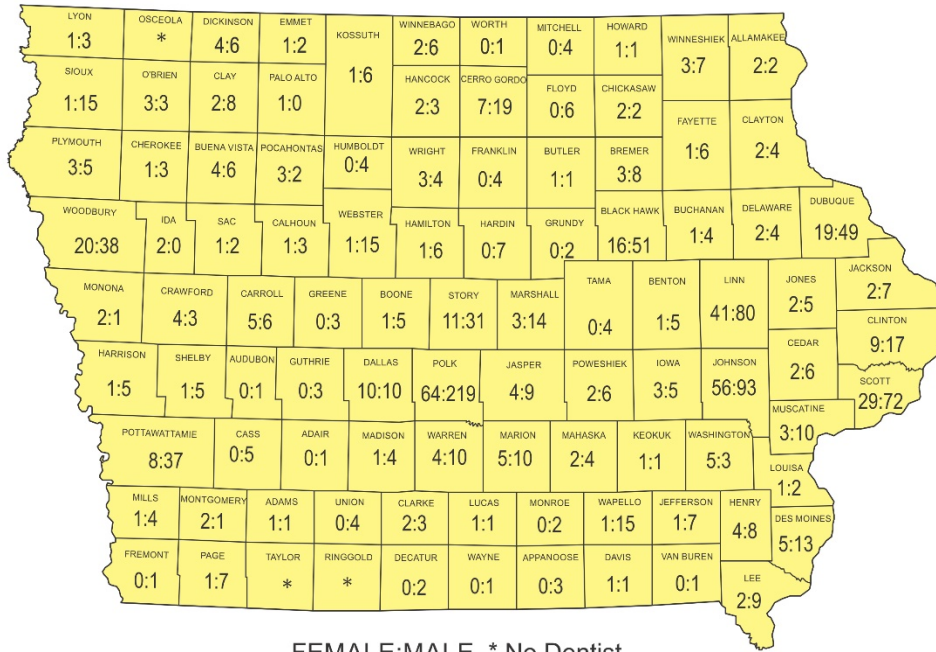


Figure 42. Prosthodontists in Iowa, by sex, 1997-2016

The number of male prosthodontists peaked at 35 in 2005 and diminished to 20 in 2016. The number of female prosthodontists saw a low of 2 from 2005 through 2007 and then reached a high of 8 in 2015.



FEMALE:MALE, * No Dentist

Statewide 423:1007

Figure 43. Number of dentists per county, by sex, 2016

In 2016, there were 295 female and 734 male dentists in Iowa's urban counties,⁷ indicating that females had a slightly larger presence in urban areas than in rural areas (69.6% versus 66.3%).

The number of female dentists exceeded their male counterparts in 7 counties, all of which were rural except one (Washington): Crawford (4:3), Ida (2:0), Monona (2:1), Montgomery (2:1), Palo Alto (1:0), Pocahontas (3:2), and Washington (5:3).

⁷ See section about Urbanicity of Iowa's Dentist Workforce Location for further information about urban and rural counties.

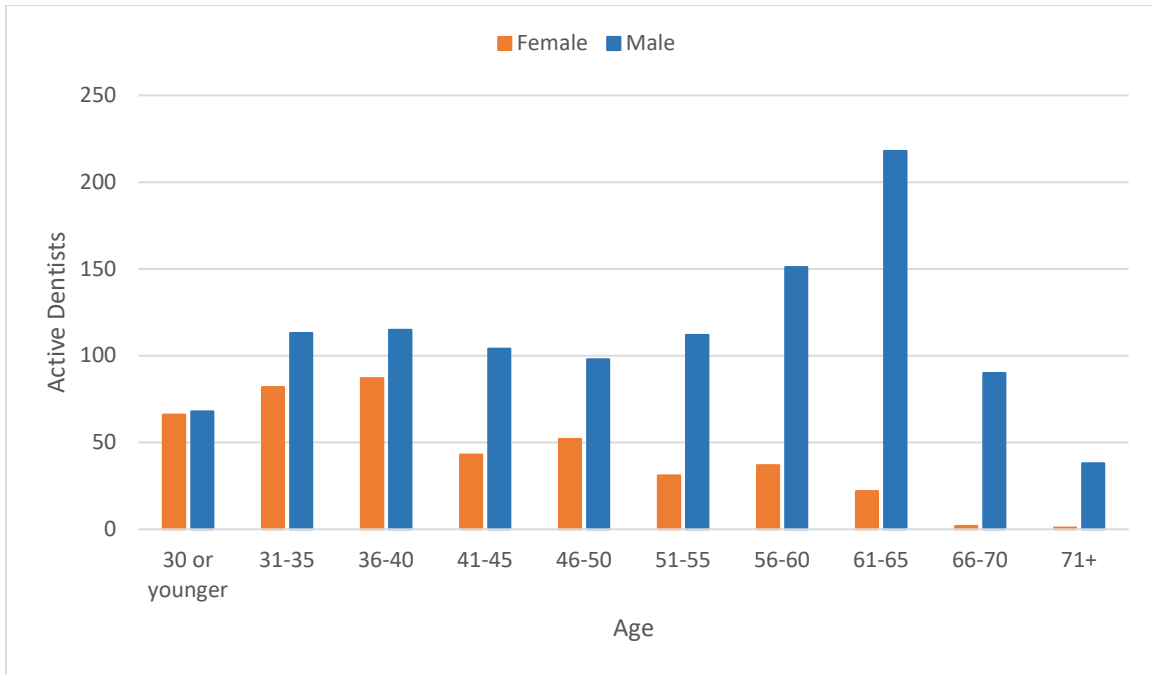


Figure 44. Age of active dentists, by sex, 2016 (N=1,530)

For decades, dentistry and medicine were almost exclusively male professions. Women started to apply and enroll in dental schools in greater numbers by the late 1980s. It is only during the past decade that women applied and enrolled in approximately equal numbers with men.

For females, the mean and median age for active dentists in 2016 were 41.6 and 39, respectively. For males, the mean and median age were 51.1 and 53, respectively.

The next chart reviews age findings from 1997.

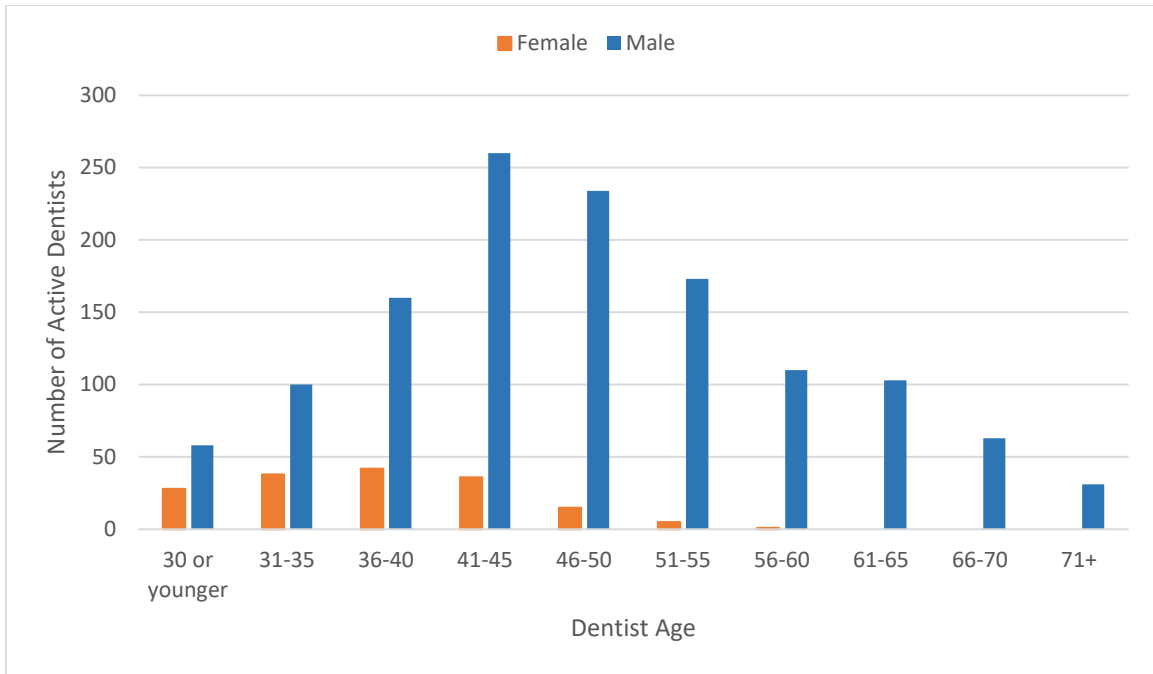


Figure 45. Age of active dentists, by sex, 1997 (N=1,447)

This figure readily illustrates two points: There was a paucity of female dentists in Iowa in 1997 and none of the females were older than 60 years of age.

The mean and median age for female dentists (n=165) in 1997 were 37.7 and 37, respectively. For males, the mean and median age were 47.9 and 47, respectively.

Race

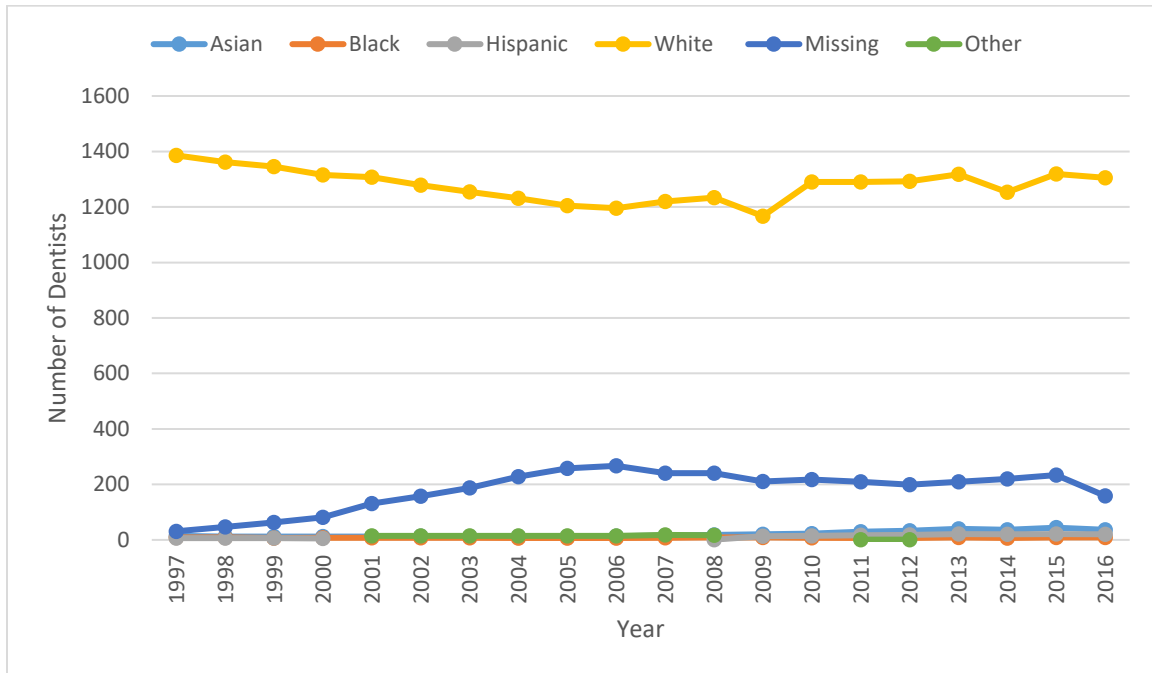


Figure 46. Racial composition of Iowa dentist workforce, 1997-2016

Within the Iowa Dentist Tracking System, collection of racial and ethnic data is the one variable that may not be as reliable due to changing measurement criteria. For example, from 1997 through 2000, there were six categories: Asian, black, Hispanic, white, missing, and other (e.g., Native American). Thereafter, the “missing” category increased annually. No individuals were identified as Hispanic until 2009, when there were some Hispanic dentists listed. The number of Hispanic dentists reached at high of 21 in 2013 and 2015.

The number of dentists with Asian heritage peaked at 44 in 2015. In the years recorded, there have never been more than 9 black dentists.

Age

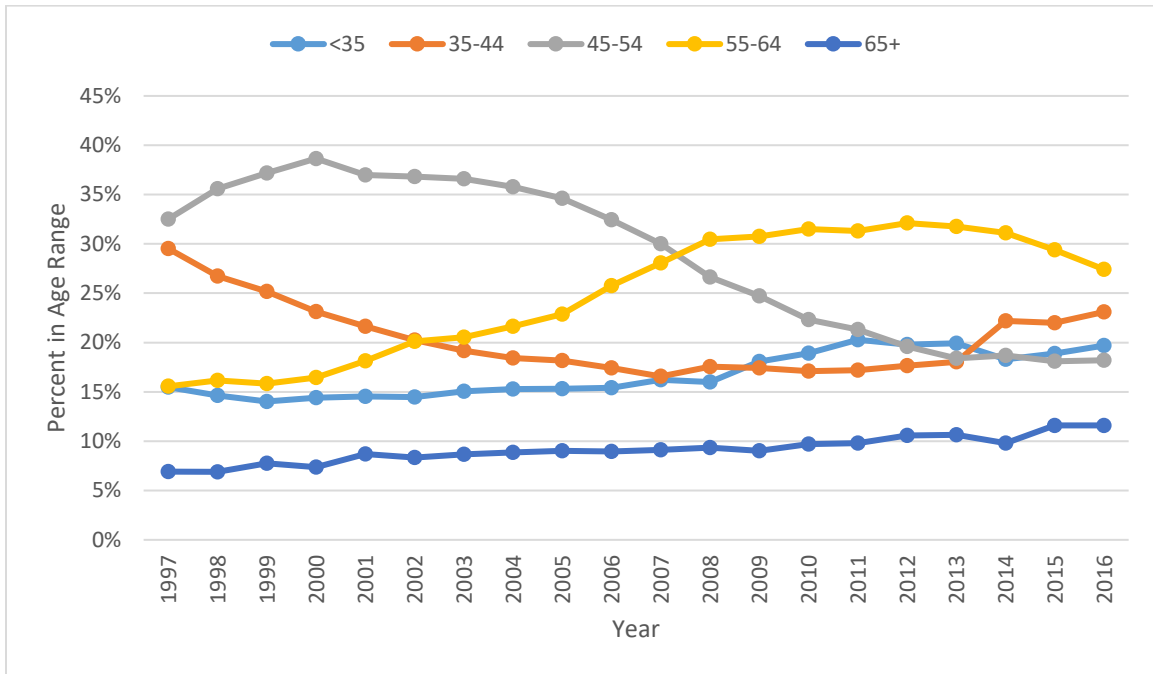


Figure 47. Percent of active Iowa dentists, by age category, 1997-2016

The age distribution of Iowa dentists, like other dentists throughout the United States for this same period, is somewhat skewed by the historically high numbers of graduates during the 1970s and early 1980s, when class sizes were greater due to a perceived shortage of health professionals, including dentists. The next graph provides a more detailed explanation about the rationale for dental school class size.

See Figure 85 for number of University of Iowa graduates per year.

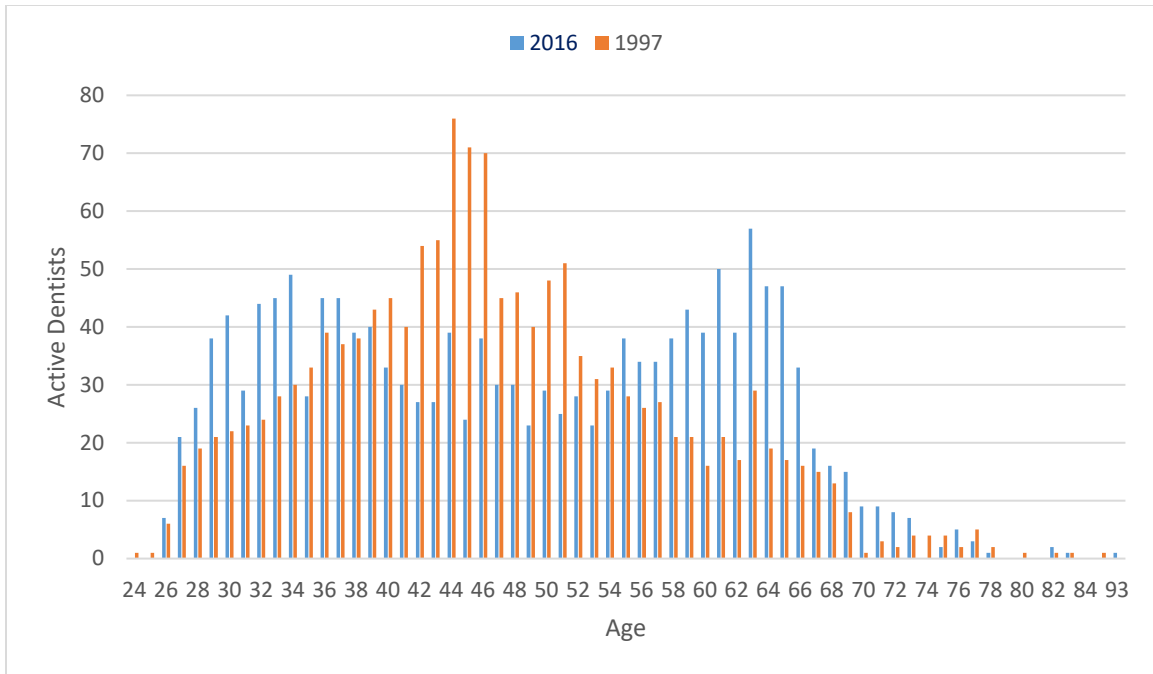


Figure 48. Age of active Iowa dentists, 1997 and 2016

This figure requires some context. The University of Iowa, along with most dental schools, increased their class size from the late 1960s through the mid-1970s in response for a national push with federal incentives to graduate more physicians and dentists. Subsequently, there was a reversal in enrollment numbers, with several dental schools, but principally private institutions, deciding to eliminate their dental schools (e.g., Farleigh Dickinson [NJ], Loyola [IL], Oral Roberts [OK], Northwestern [IL]).

The University of Iowa, like most dental schools, curtailed enrollment in the 1980s in response to a perception of an oversupply of dentists coupled with less prevalence of dental decay among school-aged children. (During the last couple of decades, however, several new dental schools have opened, and many dental schools gradually started to increase the number of enrollees.)

The 1997 data represent the relatively large number of dentists 42 to 52 years of age, most of whom were part of the increase in enrollment that occurred during the 1960s and 1970s. That age cohort is reaching historical natural retirement between 2010 and 2020. However, as explained in the Inflow/Outflow section, many dentists postponed retirement during the Great Recession.

Thus, while there is a unimodal peak (44-46 years of age) for 1997, there is a bimodal age distribution in 2016, with substantial numbers of dentists ages 29 through 40 and 55 through 66.

Mean and median age of active Iowa dentists in 1997 were 46.7 and 46, respectively. In 2016, the mean and median age were 48.5 and 48, respectively.

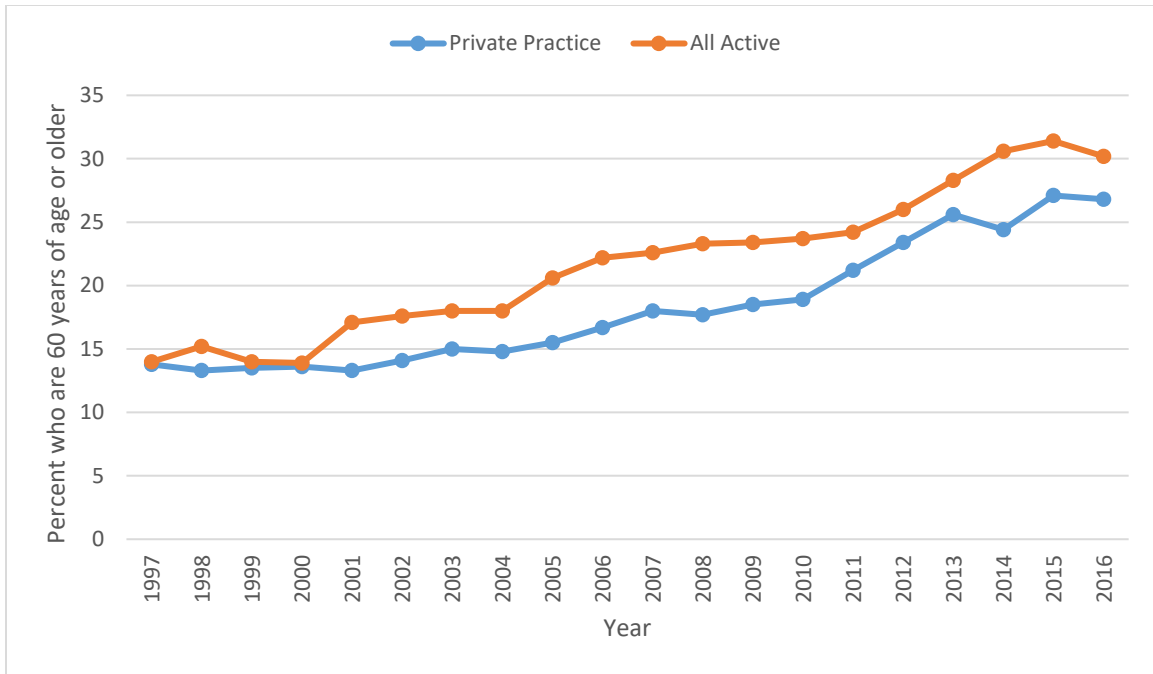


Figure 49. Percent of Iowa private practice dentists who are 60 years of age or older, 1997-2016

The percent of active Iowa dentists who were 60 years of age and older rose from 13.9% (2000) to peak at 31.4% (2015). For private practitioners, the percent of dentists 60 years of age or older ranged from 13.3% (1998) to 27.1% (2015).

There are several possible explanations for this increase. First, since the peak graduation rates occurred in the 1970s and early 1980s, this cohort reflects the natural retirement age. Second, the Great Recession (2007-2008) in the United States may have had a strong influence about when practitioners retired. Third, the increase in group practices may allow for older practitioners to phase into retirement (i.e., work part-time) for a few years prior to full retirement.

Based on available information, we anticipate that the percent of Iowa private practice dentists who are 60 or older will continue to drop during the next couple of decades.

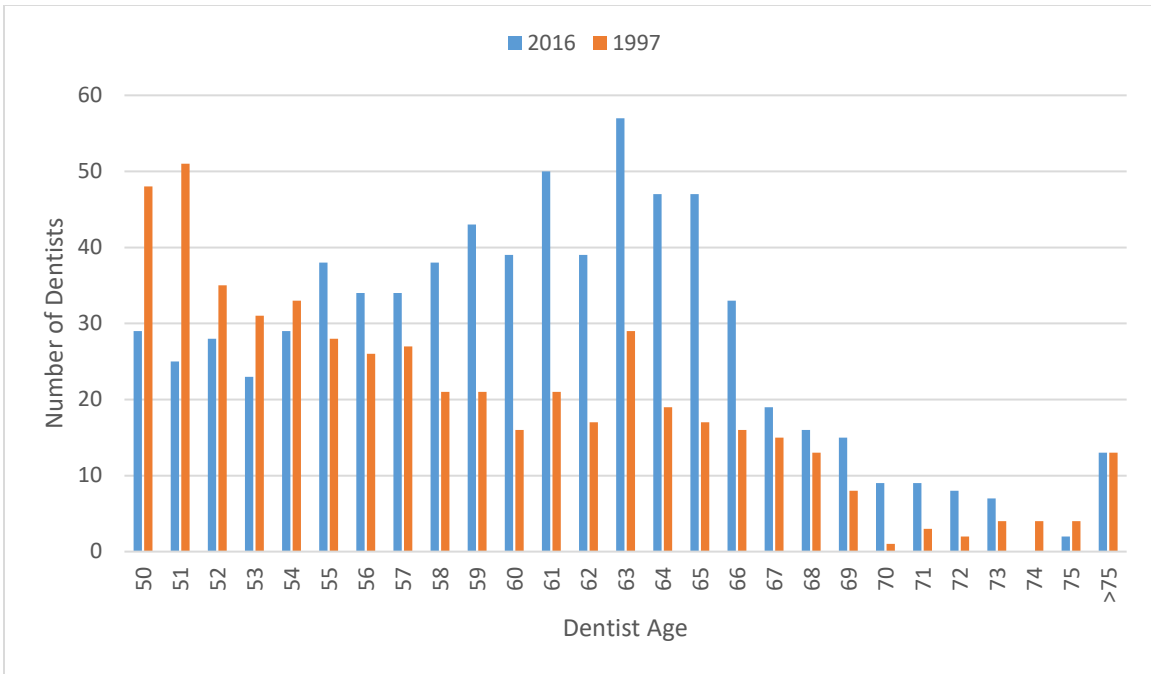


Figure 50. Distribution of Iowa active dentists greater than 50 years of age, 1997 and 2016

This figure displays the age distribution of dentists age 50 years and older for 1997 and 2016. The bars for 2016 are a subset of Figure 48, which highlighted the higher graduation rates for the 1970s and early 1980s.

Practice Activity (Other than Private Practice)

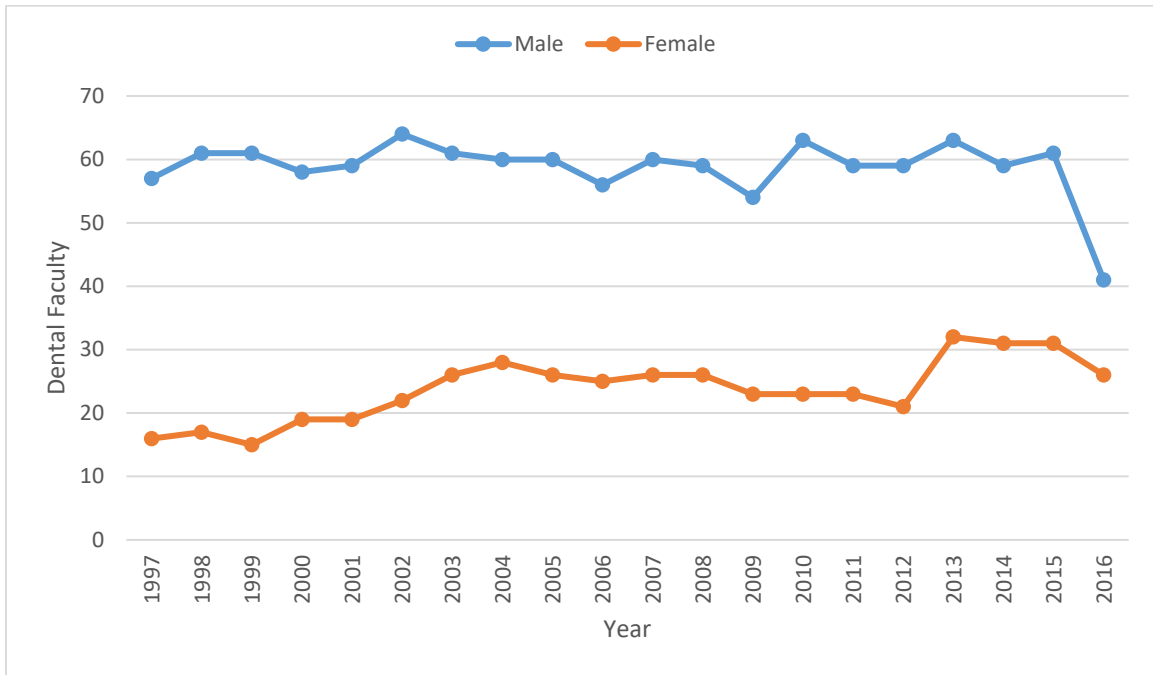


Figure 51. Iowa dentist faculty, by sex, 1997-2016

With the exception of 2016, the number of male faculty ranged between 54 and 64. However, an early retirement incentive, coupled with a large older faculty workforce, saw a substantial drop (to 41) in male faculty members in 2016. The number of female faculty rose to a high of 32 in 2013, but the number has slightly dropped during the final few years of this time period.

The total number of dentist faculty peaked at 95 in 2013.

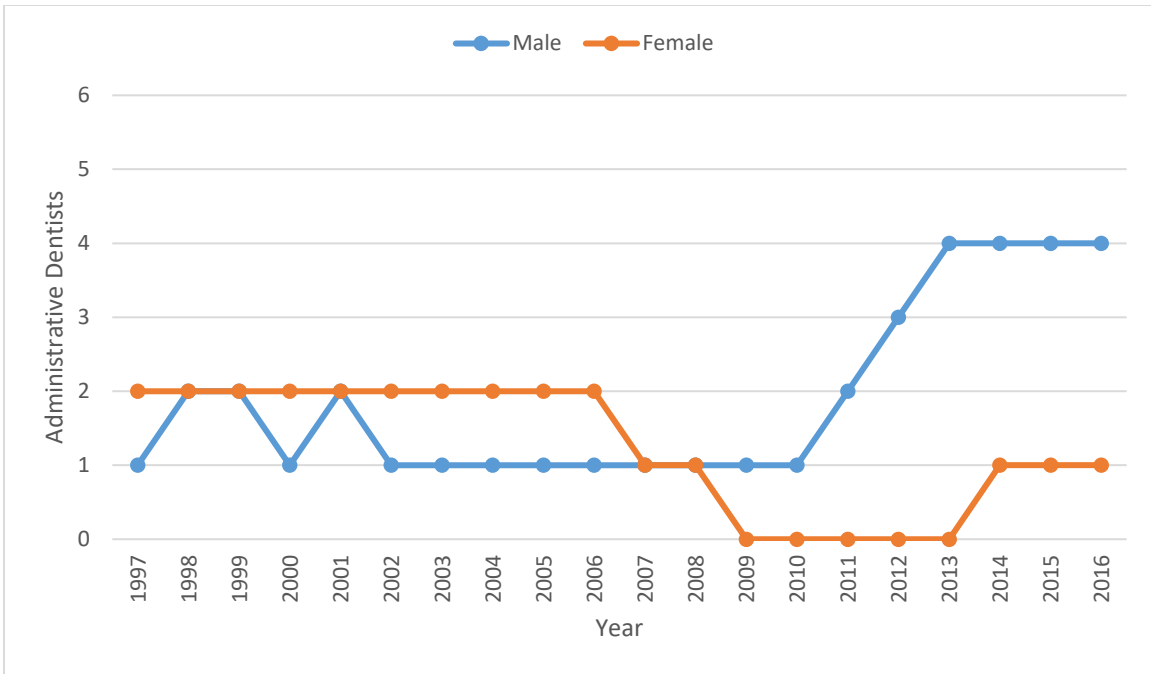


Figure 52. Iowa dentists with an administrative position, by sex, 1997-2016

There were very few Iowa dentists who primarily had their primary employment as an administrator. In any year there were 5 or fewer individuals who held an administrative position.

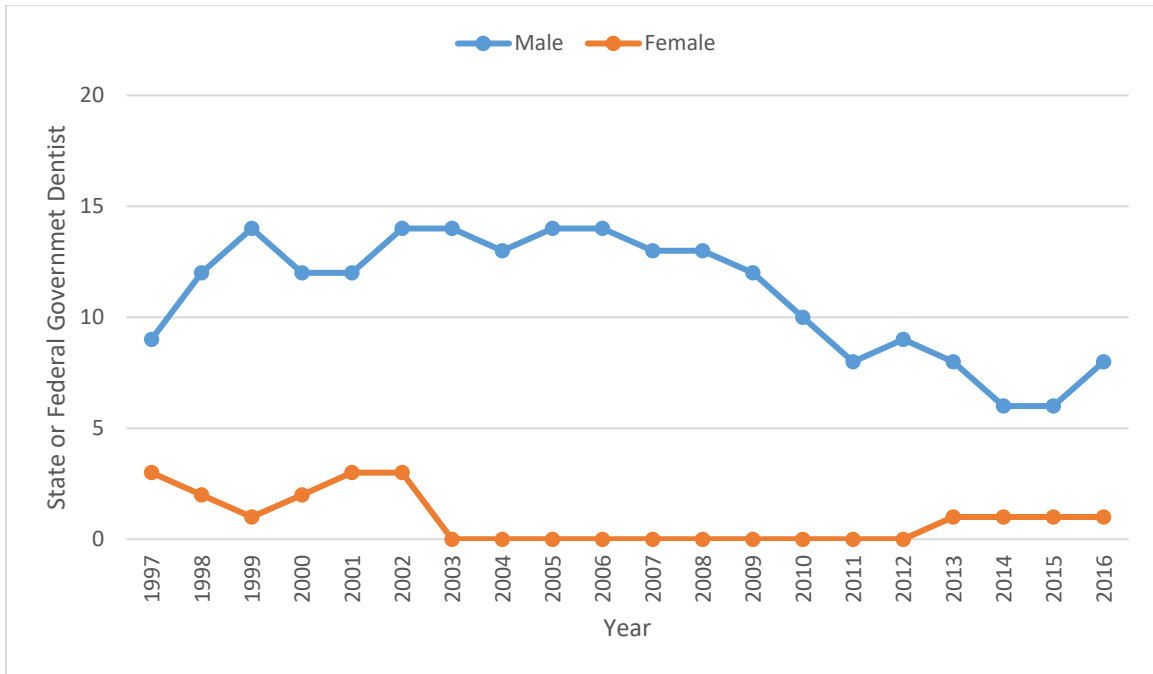


Figure 53. State or federal government dentists in Iowa, by sex, 1997-2016

There were several more male dentists who were employed in state or federal positions, exclusive of the Office of Veterans Affairs. There were as many as 14 male dentists in these positions, but that number has trailed off since 2006. There have been very few female dentists in state or federal government positions, with the maximum (3) occurring in 1997, 2001, and 2002.

Note that the Iowa Dentist Tracking System differentiates dentists who are employed by Veterans Affairs and those who work in other federal or state positions. Thus, the current graph does not include dentists employed by Veterans Affairs. Information about VA dentists is displayed in Figure 55.

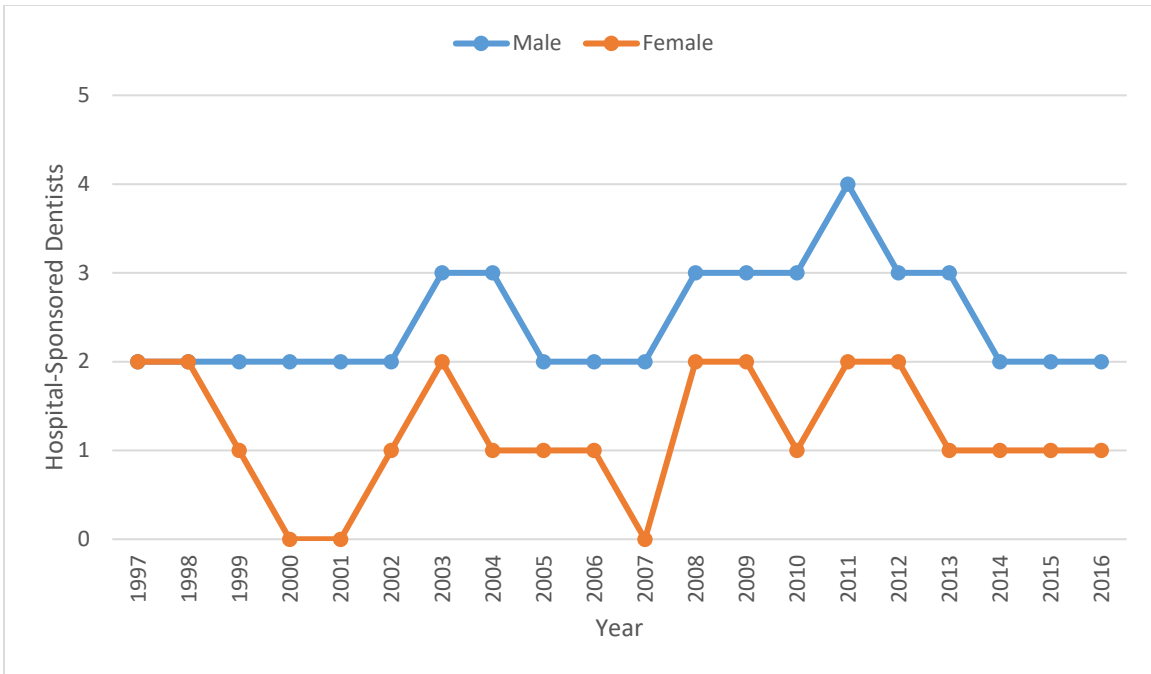


Figure 54. Hospital-sponsored dentists in Iowa, by sex, 1997-2016

There have been only a handful of hospital-sponsored dentists in any one year, with the greatest number of males (4) occurring in 2011.

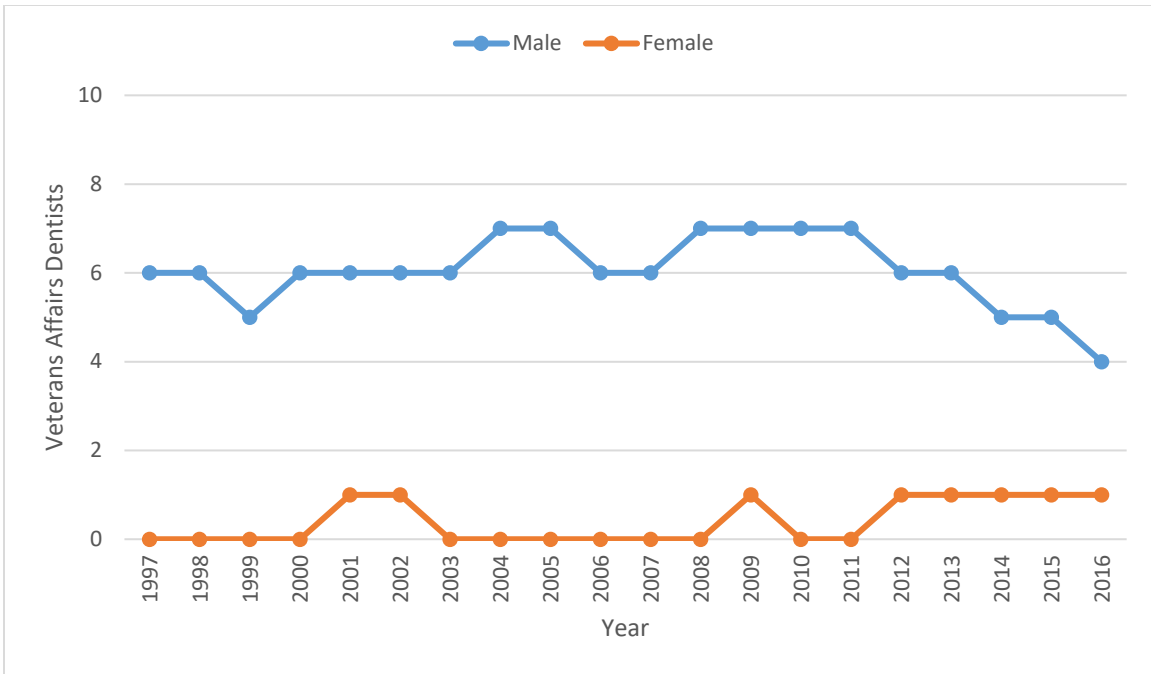


Figure 55. Veterans Affairs dentists in Iowa, by sex, 1997-2016

Besides state and federal dentists in Figure 53, the Iowa Dentist Tracking System keeps tab of the number of dentists employed by Veterans Affairs. Among males, the highest number was 7 dentists for several years between 2004 and 2011. There was never been more than 1 female dentist employed by the VA in any year during this data collection period.

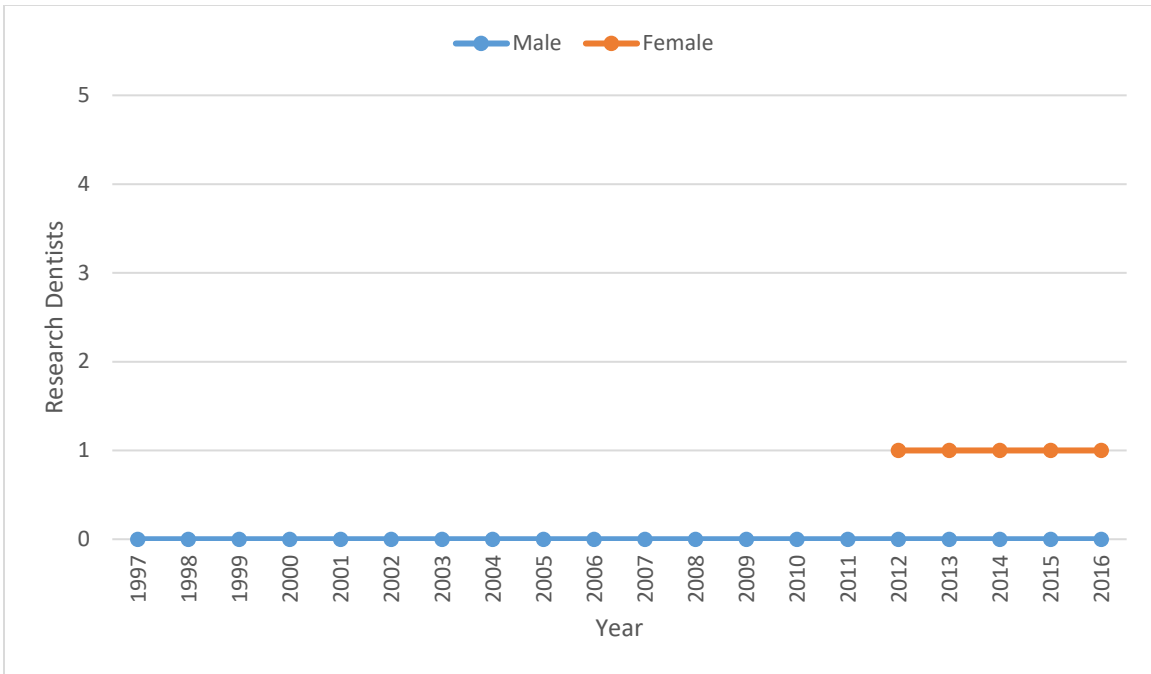


Figure 56. Full-time research dentists in Iowa, by sex, 1997-2016

Prior to 2012, there had never been a dentist who devoted his or her time to dental research. However, since 2012 there was 1 female dentist who devoted her time to pursuing dental research.

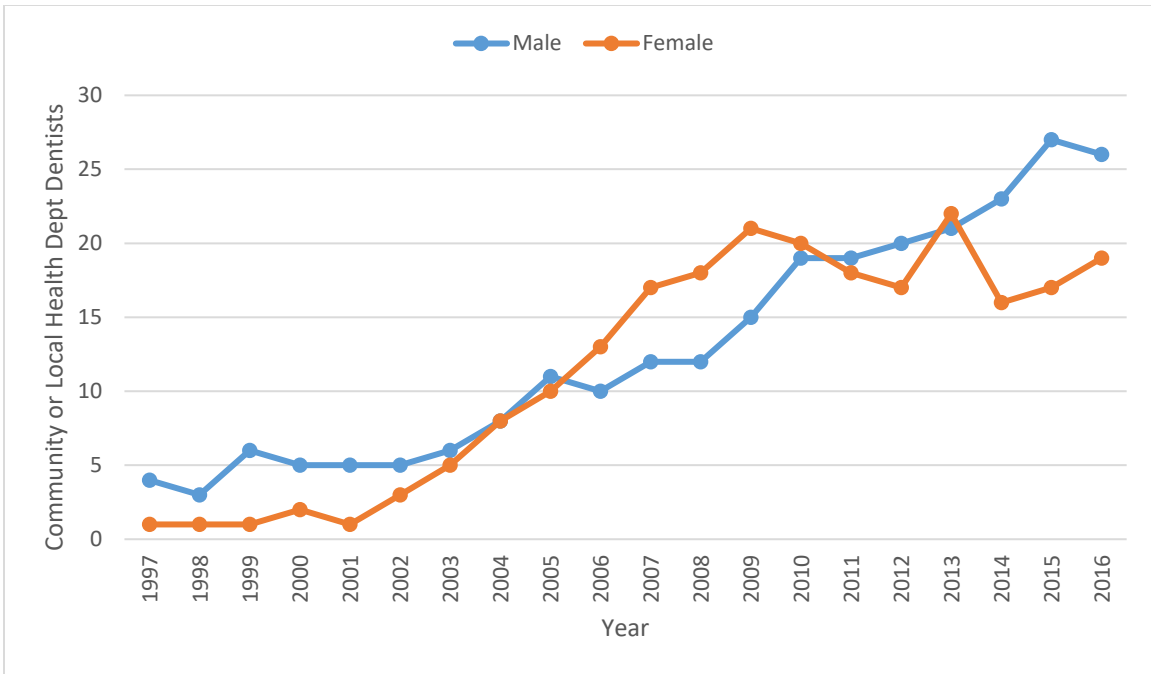


Figure 57. Community or local health department dentists in Iowa, by sex, 1997-2016

The number of dentists employed in positions either at local health departments or community health centers have increased substantially since 1997, corresponding to the increase in the number of community health centers. By 2016, there were 45 dentists employed there, almost all being in community health centers. At times there were more females than males, whereas more recently there were more male dentists. The highest number of male and female dentists in any one year were 27 in 2015 and 22 in 2013.

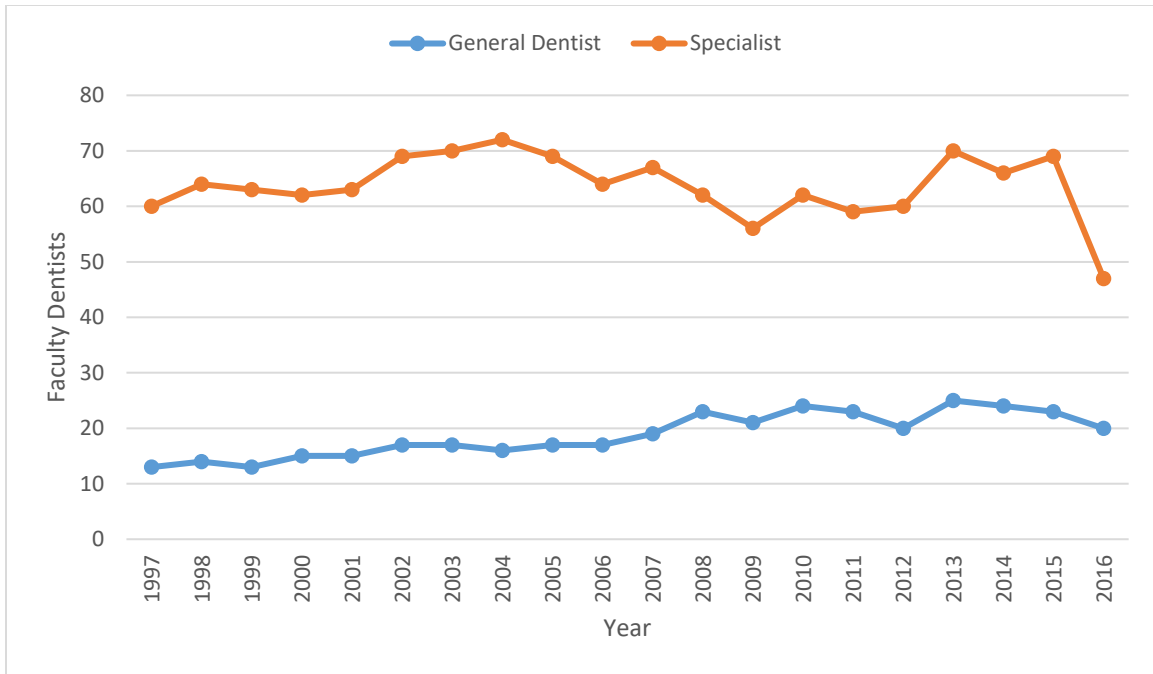


Figure 58. Iowa dentist faculty, general dentists versus specialists, 1997-2016

The number of dental specialists whose primary employment was in educational institutions far exceeded the number of general dentists at educational institutions. For most years there were 60 or more dental specialists in faculty positions. That number dropped dramatically to 47 in 2016, coinciding with a retirement incentive for faculty members.

The number of general dentists ranged from a low of 13 in 1997 and 1999 to a high of 25 in 2013.

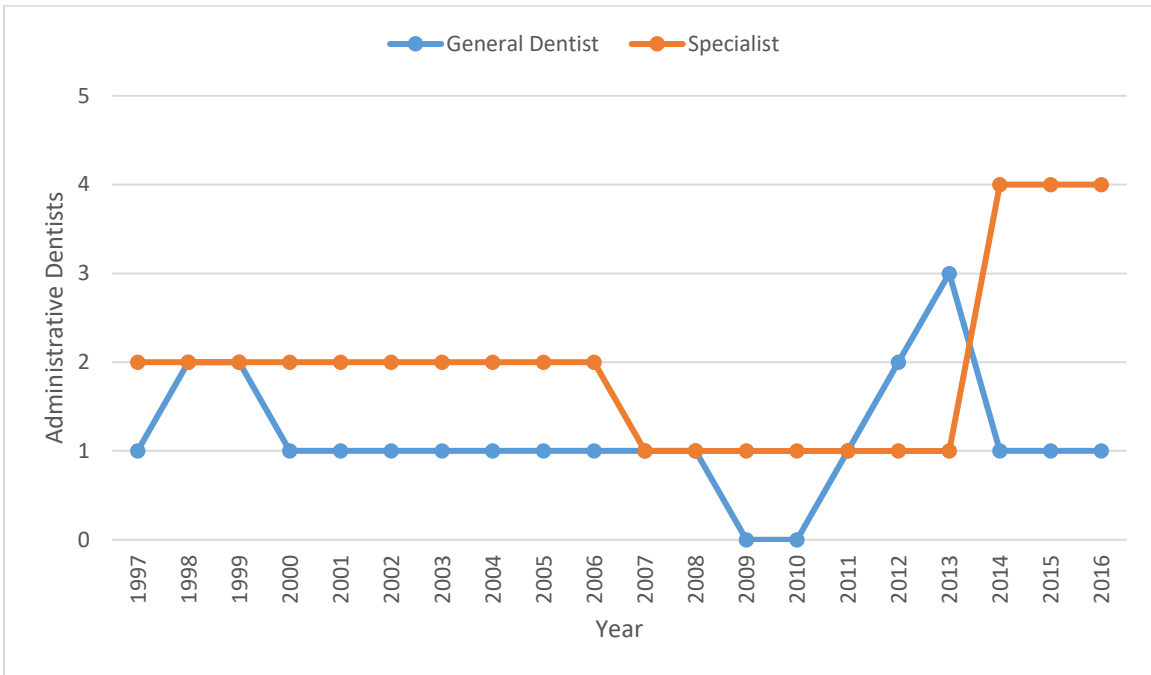


Figure 59. Iowa dentists in administrative positions, general dentists versus specialists, 1997-2016

As noted in a previous figure, there were very few dentists primarily occupied in an administrative position. In most years, the number of dental specialists in administrative positions exceeded general dentists, but the differences were extremely small.

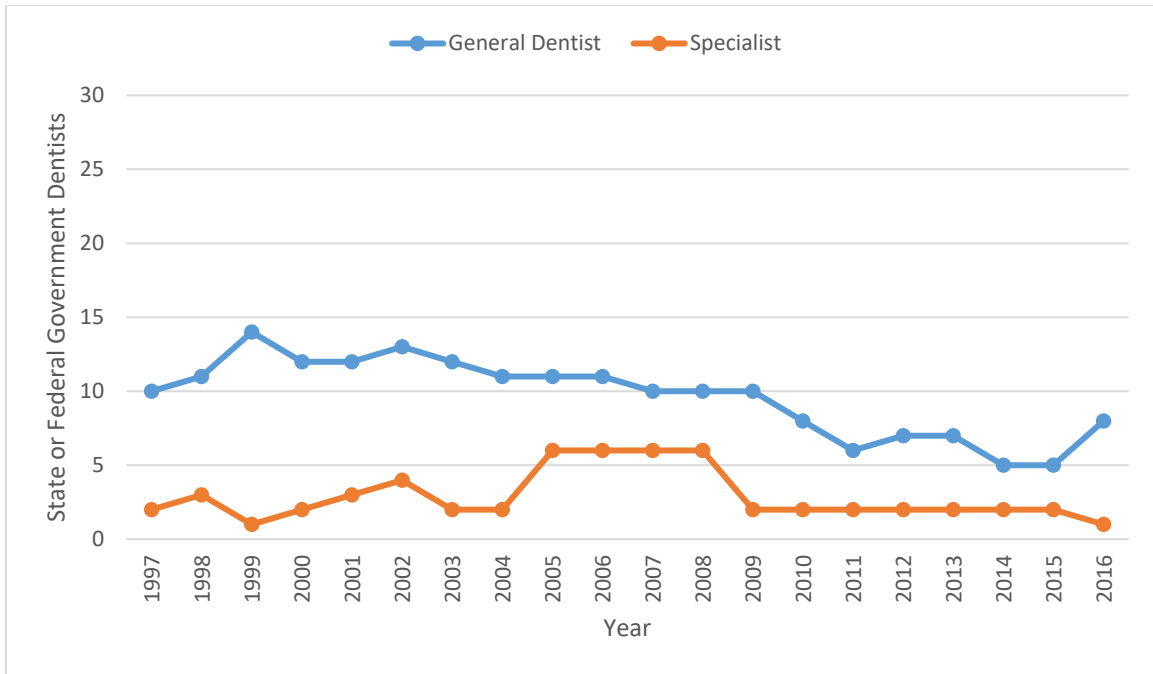


Figure 60. State or federal government dentists in Iowa, general dentists versus specialists, 1997-2016

The number of general dentists whose primary employment was either with a state or federal institution exceeded that of dental specialists for each year of this analysis. The number of general dentists had gradually declined through 2015, with a low of 5 (in 2014 and 2015) and a high of 14 (in 1999). There were 6 dental specialists in state or federal government positions from 2005 through 2008. From 2009 forward, there were 2 or fewer dental specialists employed in state or federal positions.

Note that the Iowa Dentist Tracking System differentiates dentists who are employed by Veterans Affairs and those who work in other federal or state positions. Thus, the current graph does not include dentists employed by Veterans Affairs.

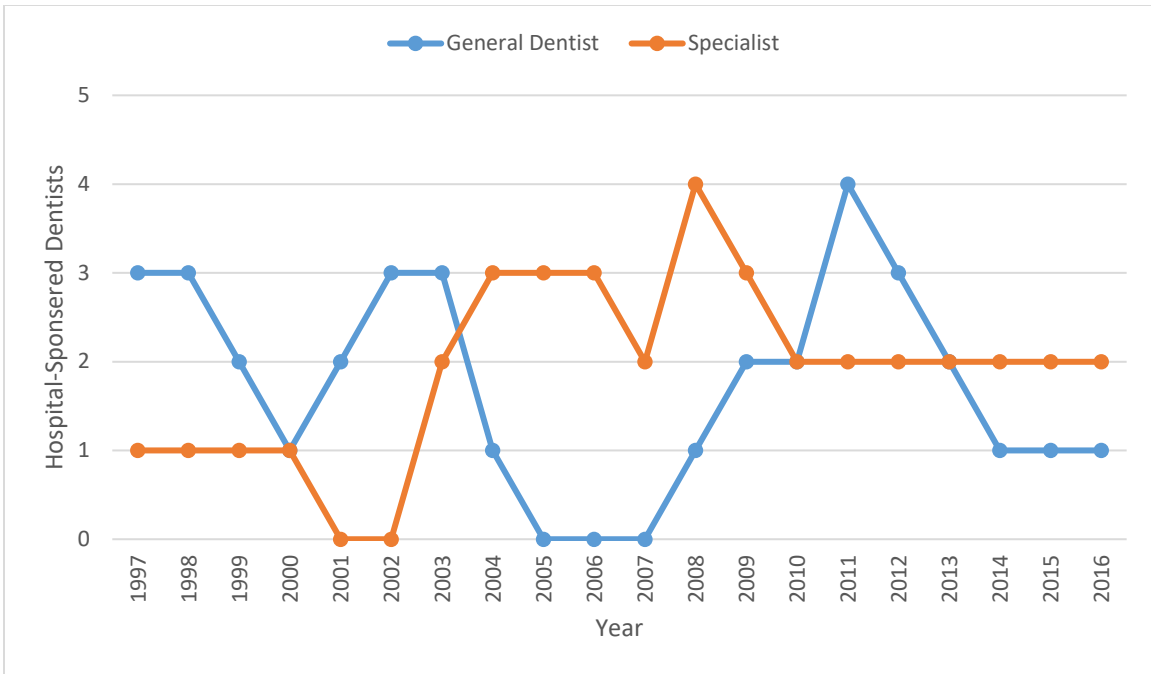


Figure 61. Hospital-sponsored dentists in Iowa, general dentists versus specialists, 1997-2016

As noted previously, there were few dentists who held hospital-sponsored positions. In some years, the number of dental specialists exceeded general dentists and vice versa. However, the numbers are too small to draw any inferences.

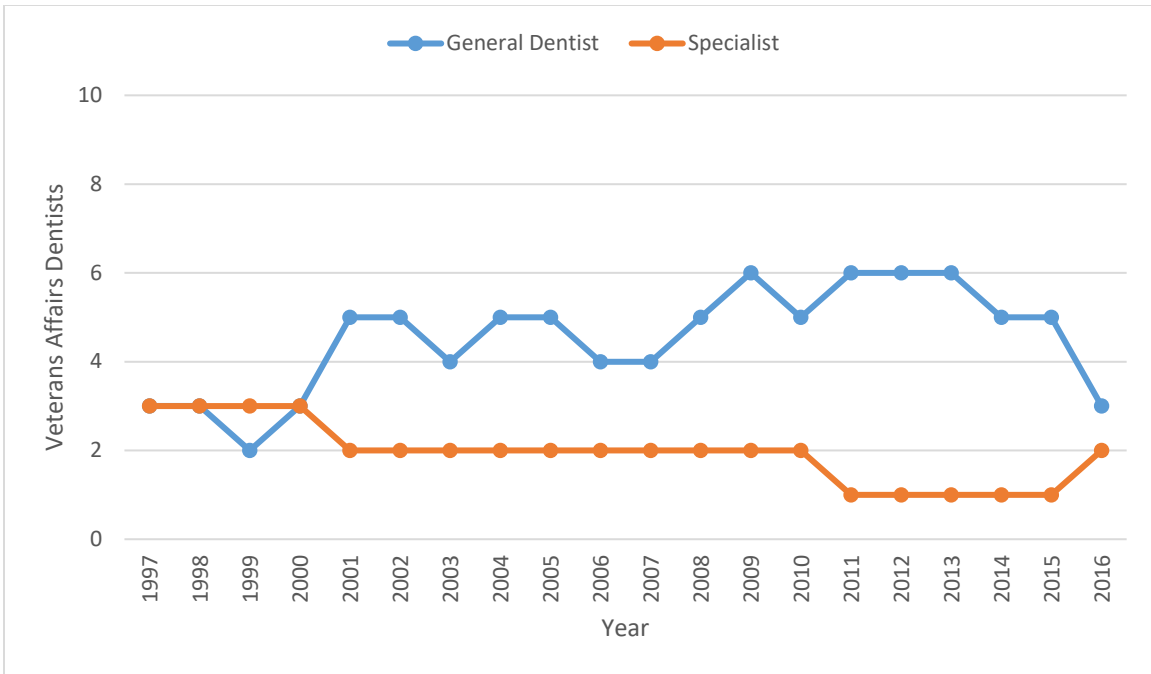


Figure 62. Veterans Affairs dentists in Iowa, general dentists versus specialists, 1997-2016

Except for the early years of this period, the number of general dentists working for Veterans Affairs exceeded the number of dental specialists.

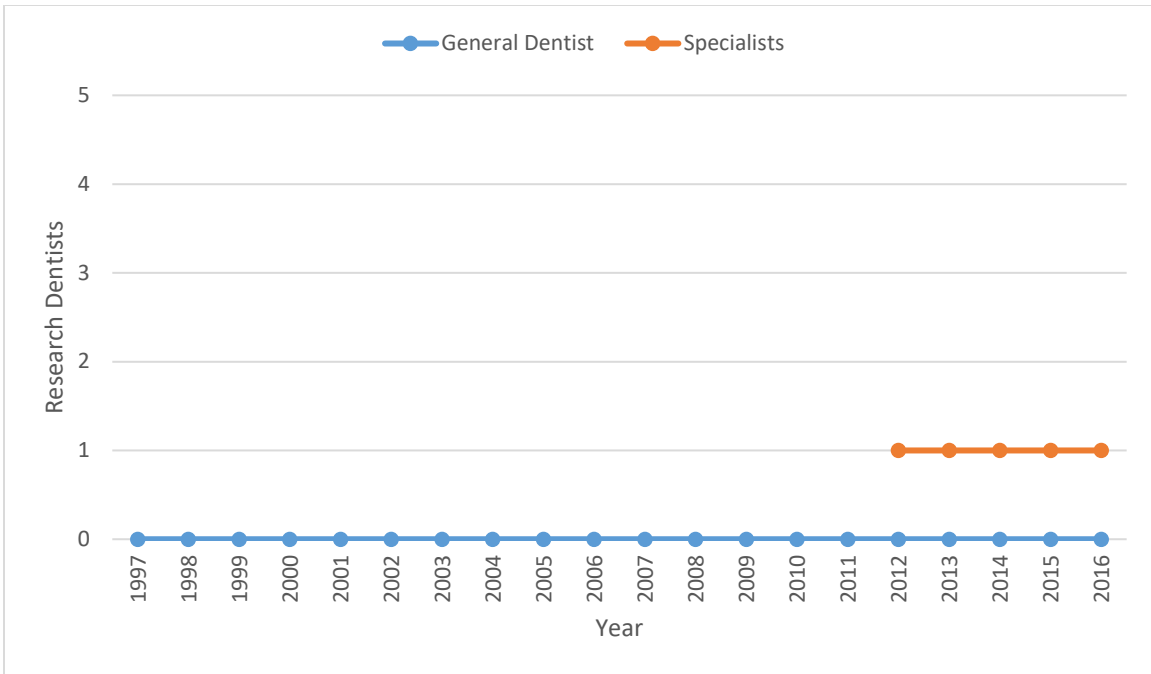


Figure 63. Full-time research dentists, general dentists versus specialists, 1997-2016

The only person devoted to full-time research was a prosthodontist.

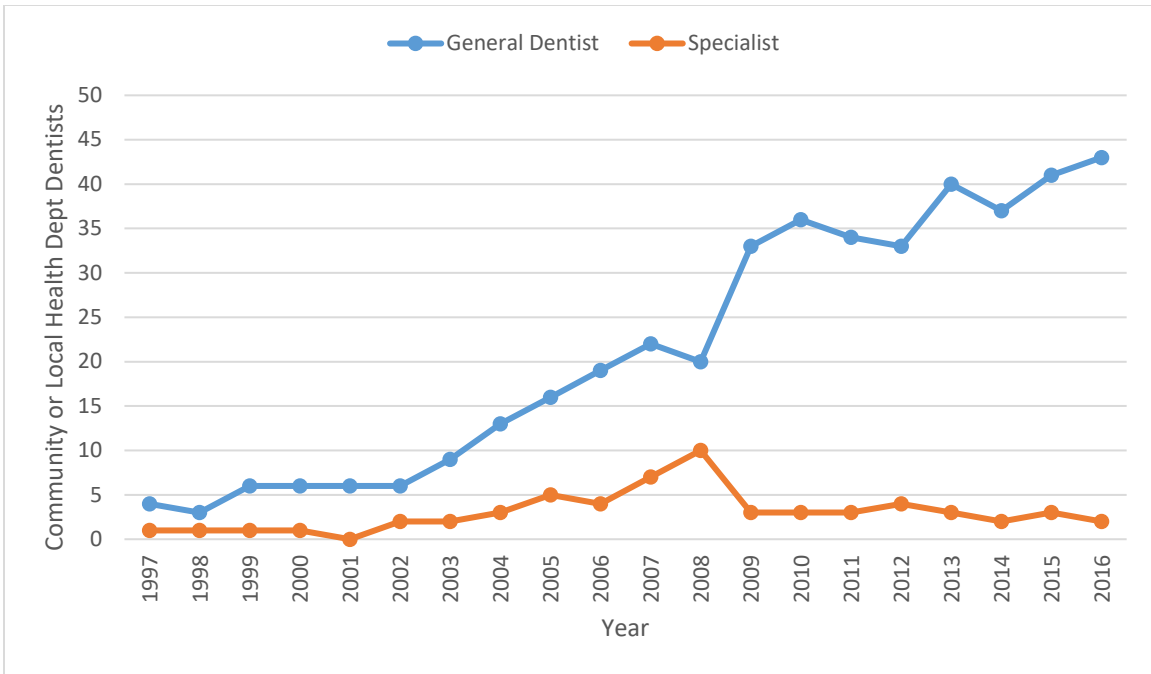


Figure 64. Community or local health department dentists, general dentists versus specialists, 1997-2016

There were few dental specialists working at local health departments or community health centers, with at most 10 (in 2008) being employed in this setting.

The trajectory for the number of general dentists in this type of setting has grown steadily from 3 in 1997 to 43 in 2016. This rise coincided with the increase in the number of community health centers during this period.

Practice Arrangement

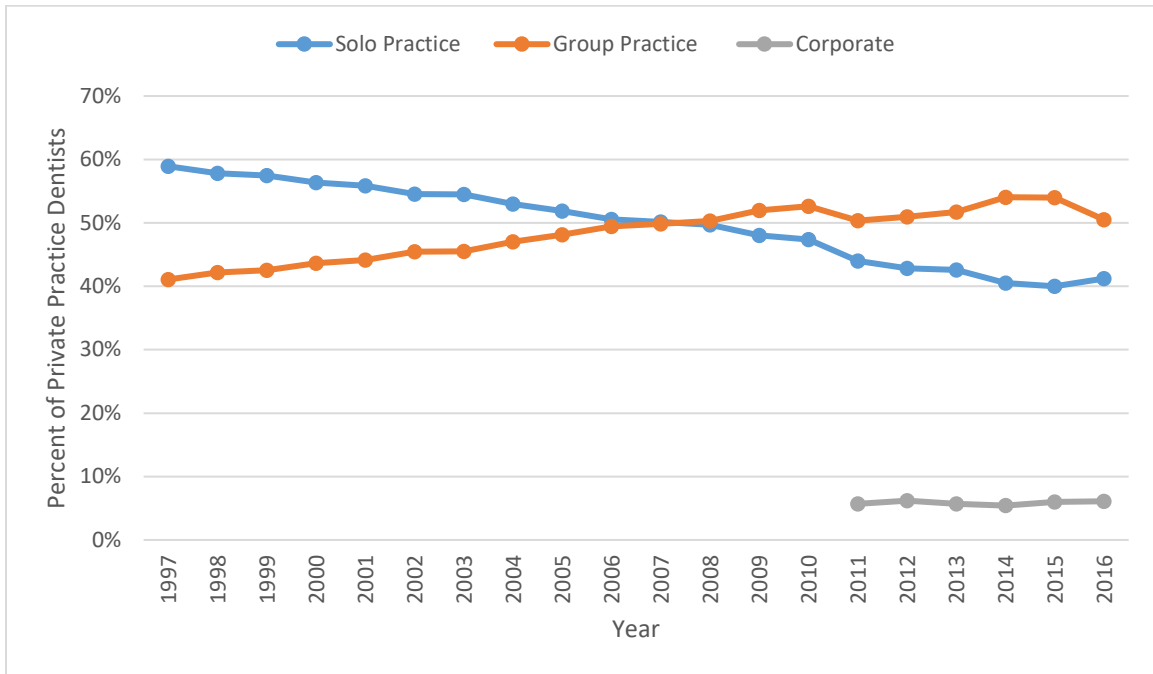


Figure 65. Percent of Iowa private practice dentists, by practice arrangement, 1997-2016

In 1997, 58.9% of Iowa's private practitioners were in solo practice. That percentage declined to 40.0% in 2015. Conversely, the percent of practitioners in group practice increased from 41.1% (1997) to 54.0% (2014 and 2015), with group practice displacing solo practice as the leading practice arrangement modality in 2008.

Corporate dentistry was introduced as a practice arrangement option in 2011. Since then, the percentage of dentists in corporate practice has ranged from 5 to 6%.

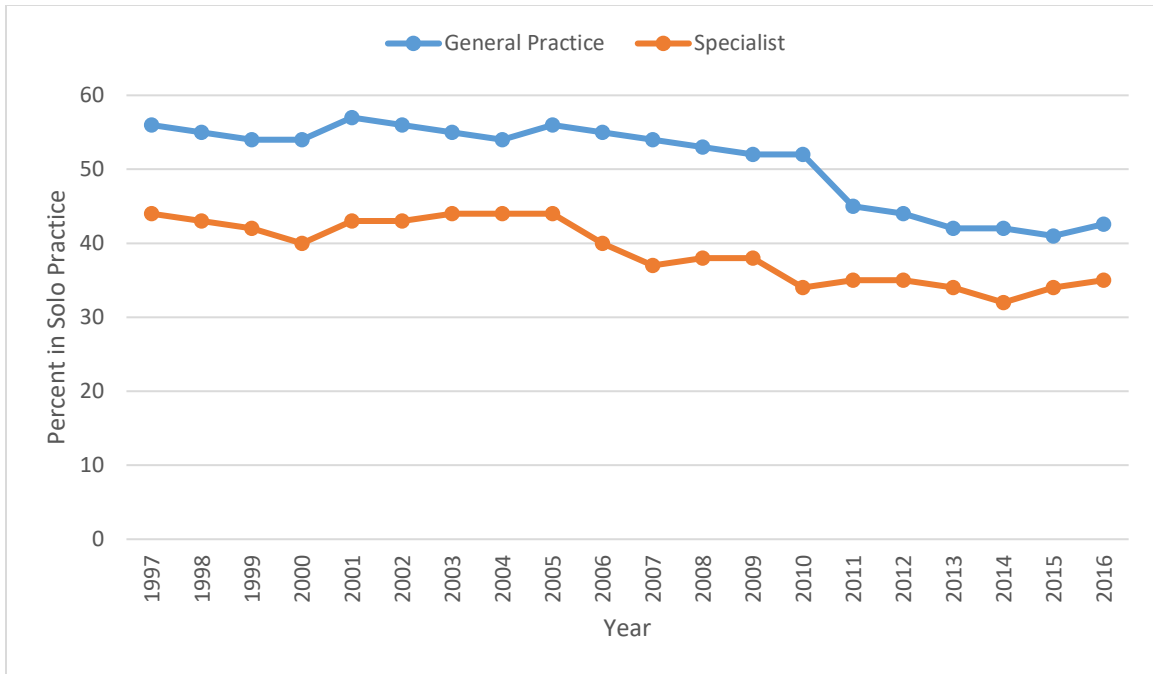


Figure 66. Percent of private practice general dentists and specialists in solo practice, 1997-2016

The percentage of general dentists and dental specialists in private practice who were in solo practice declined in both groups. The percentage of general dentists in solo practice decreased from 56% (1997) to 41% (2015). Although the percentage of private practice dental specialists in solo practice also declined, there was a slight difference. There were several years (1997, 2003-2005) in which 44% of dental specialists practiced alone, with the percent falling to as low as 32% in 2014. The percentage gap between the 2 groups had slightly decreased by the end of this 20-year period.

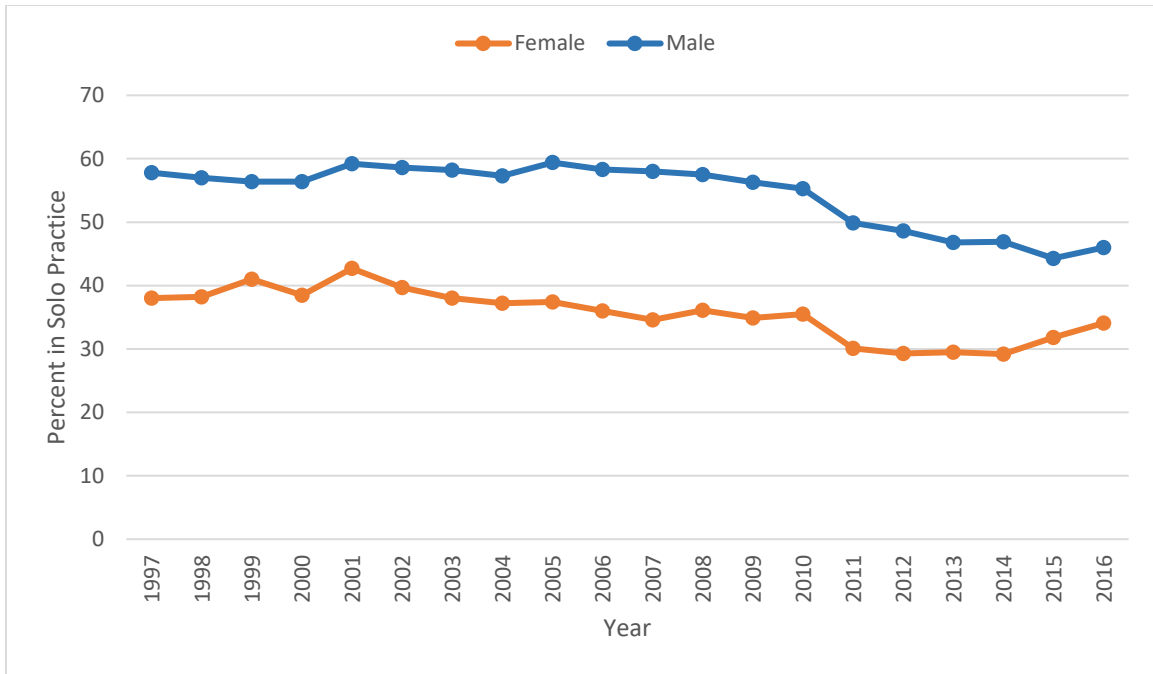


Figure 67. Percent of private practice general dentists in solo practice, by sex, 1997-2016

There was a decline in the percent of both male and female private practice general dentists who worked as solo practitioners. However, males started at a higher percent, differing from their female colleagues by 20 percentage points.

The percent of male private practice general dentists remained between 55 and 60% up until 2010. Thereafter, the percent dipped as low as 44% (2015). The percent of female private practice general dentists bottomed out at 29% in 2014, with an uptick for the final 2 years of this analysis.

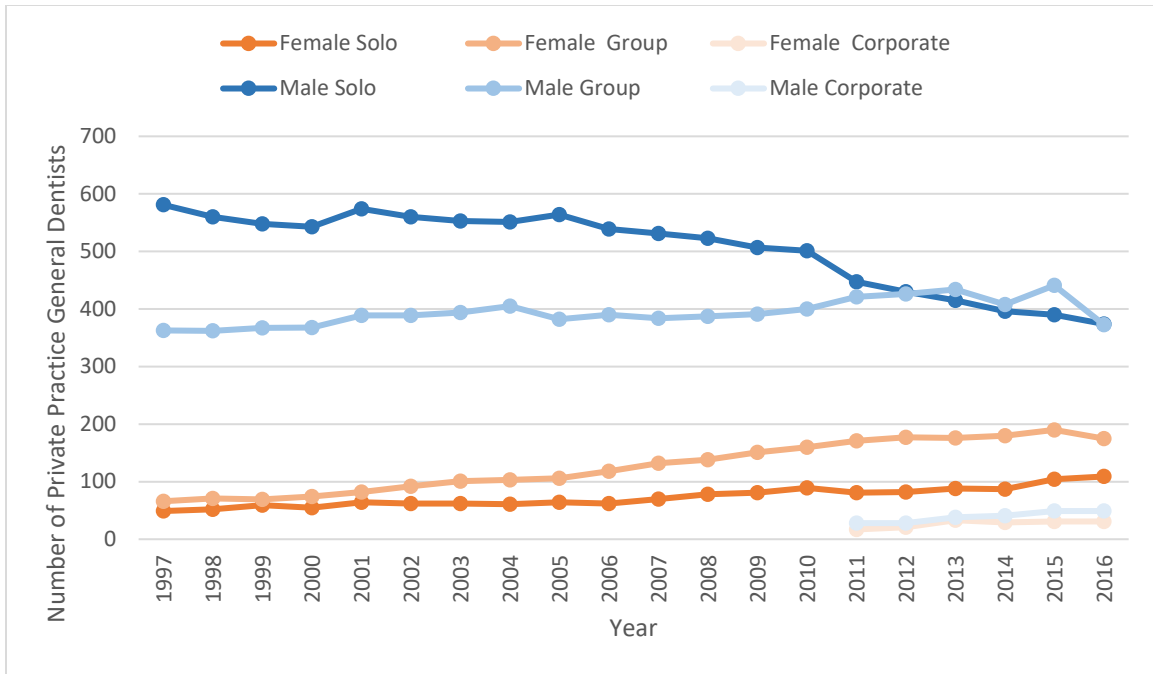


Figure 68. Number of private practice general dentists, by sex and practice arrangement, 1997-2016

The number of male dentists in solo practice decreased from a high of 581 in 1997 to a low of 374 in 2016. Male dentists in group practice reached a high of 441.

The number of female dentists in solo practice and in group practice increased throughout the 20-year period. Those in solo practice went from 49 in 1997 to 109 in 2016. Females in group practice went from 66 in 1997 to peak at 190 in 2015.

There were slightly more males than females participating in corporate practice. Males peaked at 49 (2015 and 2016), whereas there were close to 30 females in corporate practice during the last 4 years of this study period.

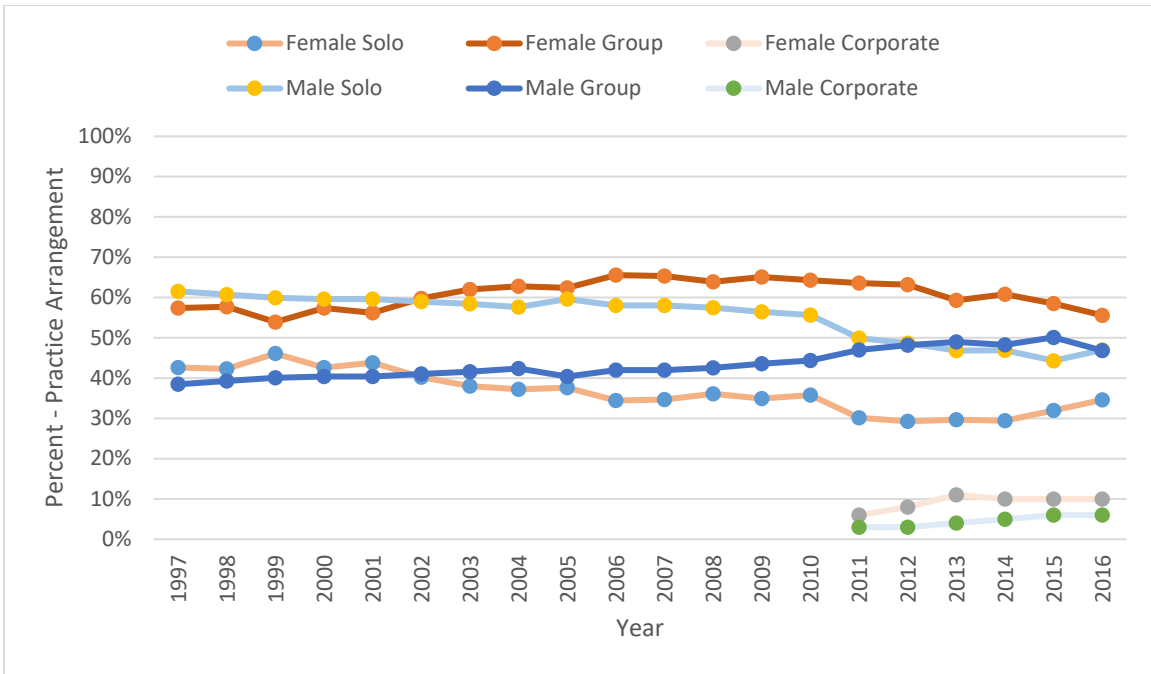


Figure 69. Percent of private practice general dentists, by sex and practice arrangement, 1997-2016

Group practice was the preferred practice arrangement for female private practice dentists in Iowa. Between 54% (1999) and 66% (2006) of female private practice Iowa dentists were in group practices, while between 29% (2012) and 46% (1999) were in solo practice.

The percent of solo male private practice dentists first crossed below the 50% mark in 2012. There has been a gradual increase in the percent of male dentists who practice in a group setting, peaking in 2015.

Although the numbers are comparatively smaller for those who were in corporate practice, the percent of women who chose this modality exceeded the percent of men who chose a corporate practice arrangement.

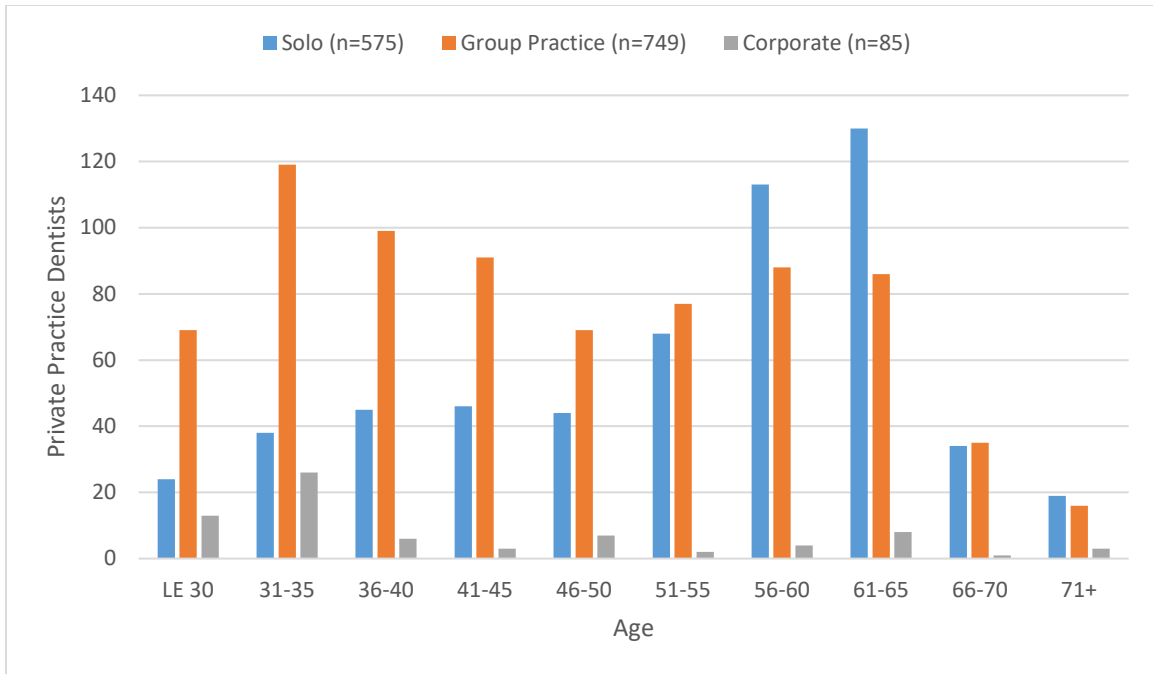


Figure 70. Age of Iowa private practice dentists, by practice arrangement, 2016 (N=1,395)

This figure is a snapshot of 2016’s practice arrangement categories by dentist age. Those in solo practice tend to be older. Group practice is the preferred arrangement for those 55 years of age and younger.

A relatively small but nevertheless substantial number of dentists were in corporate practice, especially those 35 years of age and younger. However, corporate is not limited to this age group. Variation in corporate practice involvement between age groups may be due, in large part, of what constitutes a corporate practice. The Iowa Dentist Tracking System uses a more inclusive definition, which comprises not only national organizations (e.g., Aspen) but also smaller, regional group practices that have multiple locations where the dentist retains some measure of autonomy (e.g., Heartland Dental).

The mean age was highest for solo practitioners (51.9), followed by those in a group practice (46.7), then those in corporate organizations (43.5).

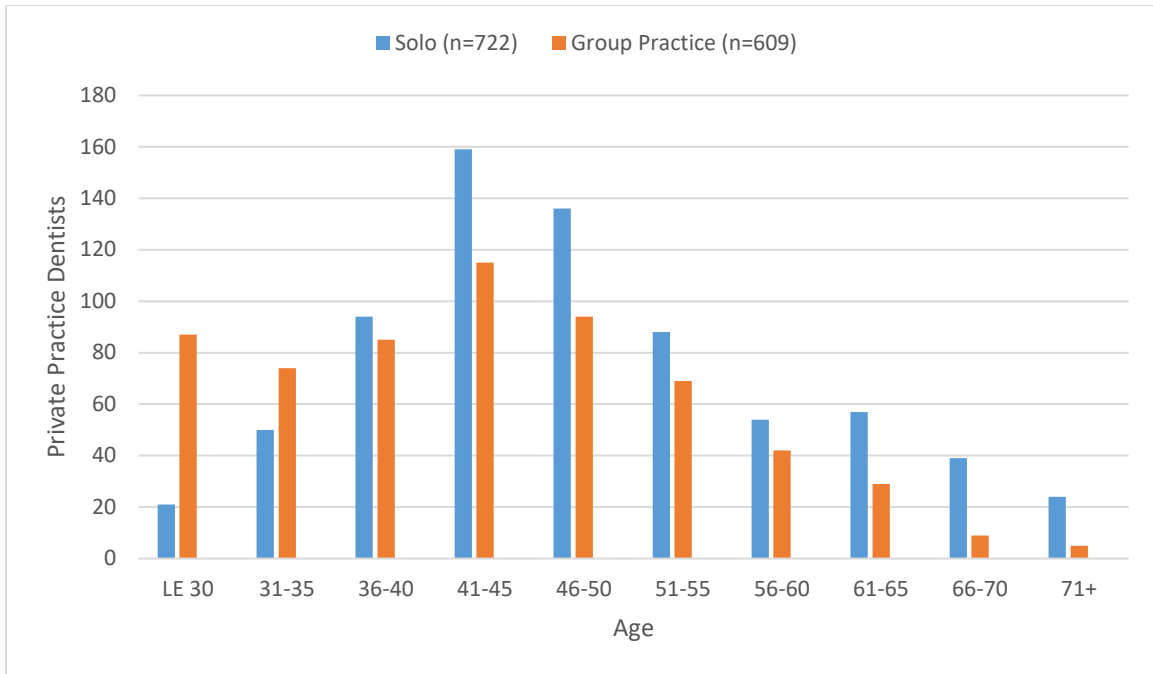


Figure 71. Age of Iowa private practice dentists, by practice arrangement, 1997 (N=1,331)

Solo practice was the predominant practice arrangement (54%) during the initial year of the tracking system. However, those 35 years of age and younger were more likely to be in a group practice, often as an associate. Although those in solo practice exceeded those in group practice for the remaining age categories, nonetheless many in each age category were in group practice.

Although information is collected about various sizes and mixes (e.g., single specialty) of group practice, we have defined any non-corporate private practice with 2 or more dentists as a “group”.

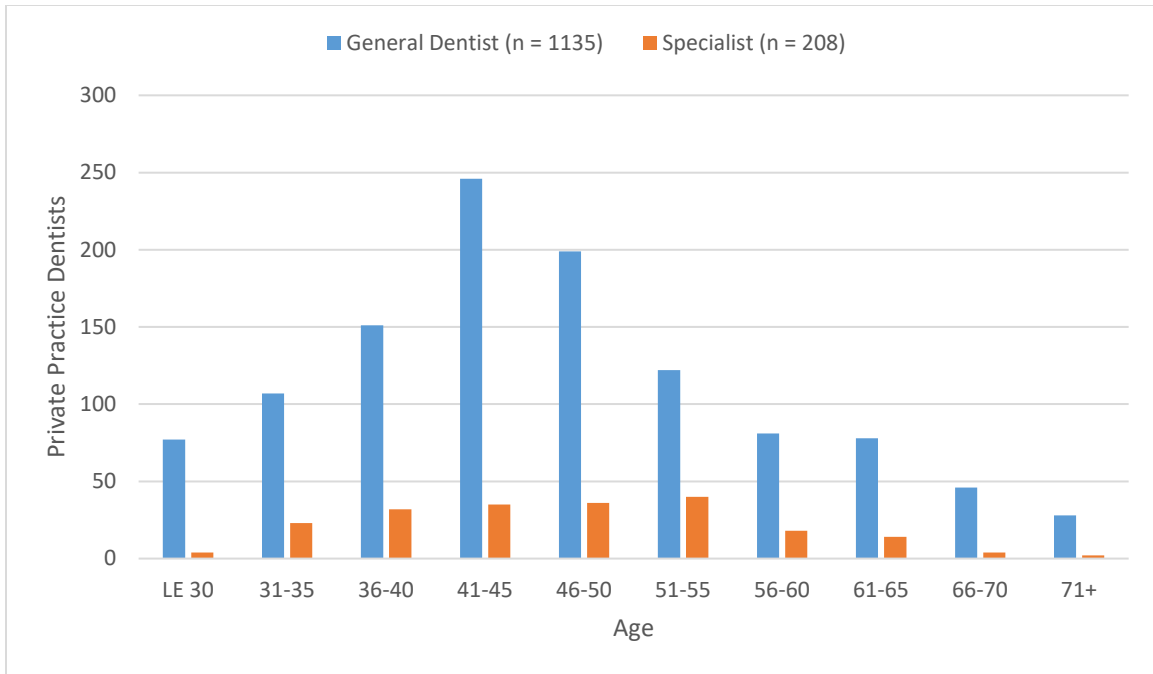


Figure 72. Age of Iowa private practice dentists, general dentists versus specialists, 1997 (N=1,343)

At the start of the Iowa Dentist Tracking System, the largest cohort of general dentists was between 41 and 50 years of age, which represented approximately 40% of the general dentists at that time.

Dental specialists accounted for 15.5% of the private practitioners in 1997.

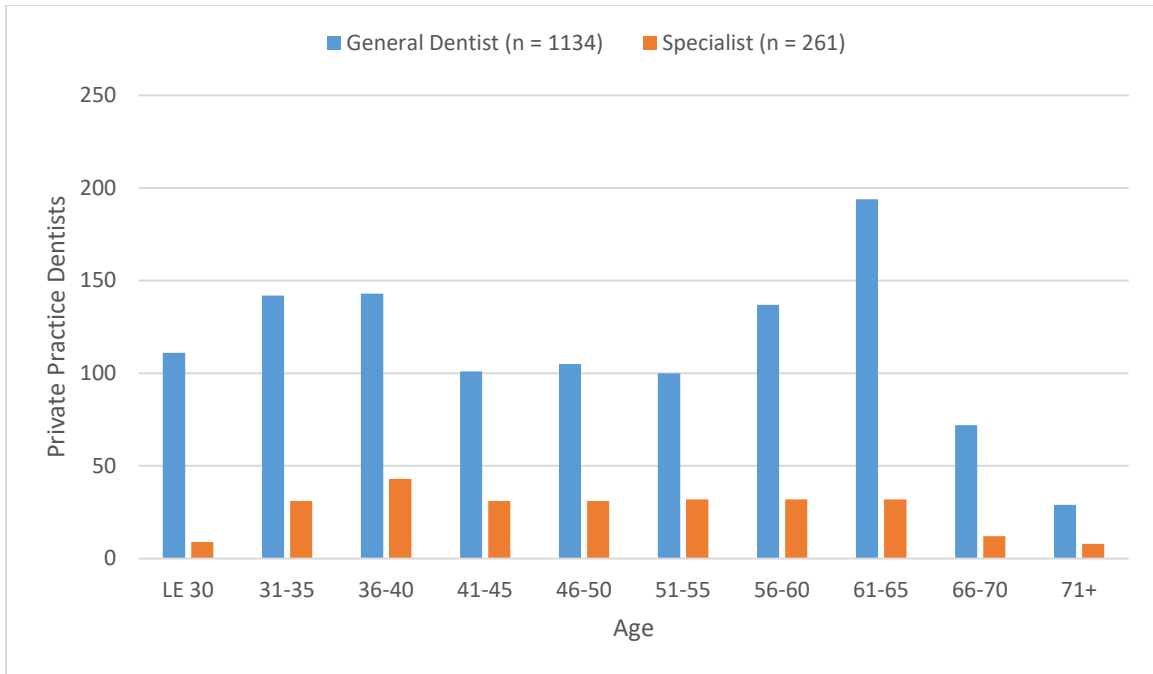


Figure 73. Age of Iowa private practice dentists, general dentists versus specialists, 2016 (N=1,395)

There was an increase of 52 private practice dentists between 1997 and 2016. Moreover, there was a shift in the age during this time, with increased numbers of those 35 years and younger and those 55 years and older.

The proportion of general dentists to dental specialists differs somewhat from that of 1997. The percent of specialists to all private practice dentists was 18.7%, an increase of more than 3 percentage points from 20 years previous. There was a 25% increase in the number of dental specialists from 208 in 1997 to 261 in 2016.

Urbanicity of Iowa's Dentist Workforce Location

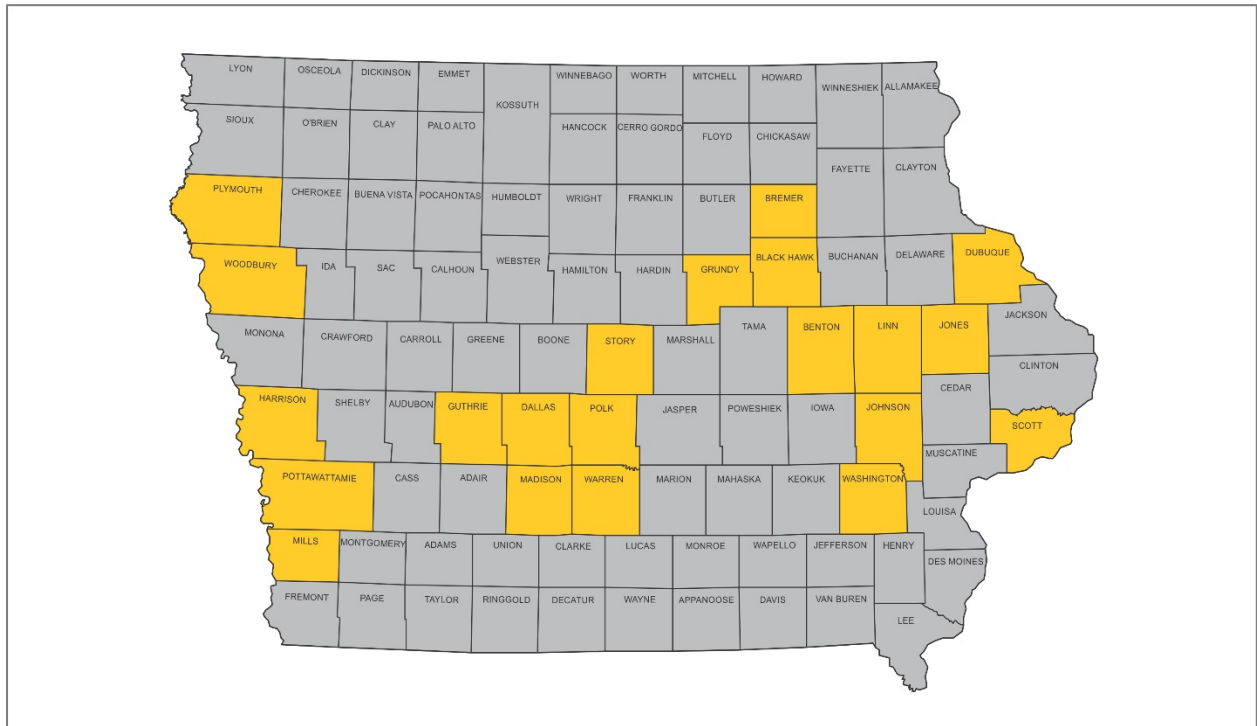


Figure 74. Iowa metropolitan counties (in gold), 2013

The 1993 edition of the US Department of Agriculture Economic Research Service's Rural Urban Continuum Codes (RUCC) indicated that there were then 10 counties designated as metro/urban. By the 2013 edition, an additional 11 counties were reclassified as metro/urban. They included the following counties followed by the 1993 RUCC codes: Benton (6), Bremer (6), Grundy (8), Guthrie (8), Harrison (6), Jones (6), Madison (6), Mills (6), Plymouth (6), Story (4), and Washington (6). No 1993 metro county converted to non-metro status.

A list of RUCC codes, their descriptions, and number of Iowa counties in each category are found in Table 6 on the next page.

Table 6. Rural-Urban Continuum Code (RUCC), 2013

| Code* | Description | Number of Iowa Counties N=99 |
|-------|--|---------------------------------|
| 1 | Counties in metro areas of 1 million population or more | 0 |
| 2 | Counties in metro areas of 250,000 to 1 million population | 12 |
| 3 | Counties in metro areas of fewer than 250,000 | 9 |
| 4 | Urban population of 20,000 or more, adjacent to a metro area | 3 |
| 5 | Urban population of 20,000 or more, not adjacent to a metro area | 5 |
| 6 | Urban population of 2,500 to 19,999, adjacent to a metro area | 26 |
| 7 | Urban population of 2,500 to 19,999, not adjacent to a metro area | 24 |
| 8 | Completely rural or less than 2,500 urban population, adjacent to a metro area | 9 |
| 9 | Completely rural or less than 2,500 urban population, not adjacent to a metro area | 11 |

*RUCC Codes 1-3 are designated as metropolitan/urban counties; codes 4-9 are non-metro (rural) counties.

More than one-half of Iowa's counties were classified as either 6 or 7 (i.e., urban populations of between 2,500 and 19,999) within the Rural-Urban Continuum Code. In addition, there were 20 completely rural counties. Only 21 counties qualified for the designation as a metropolitan/urban area.

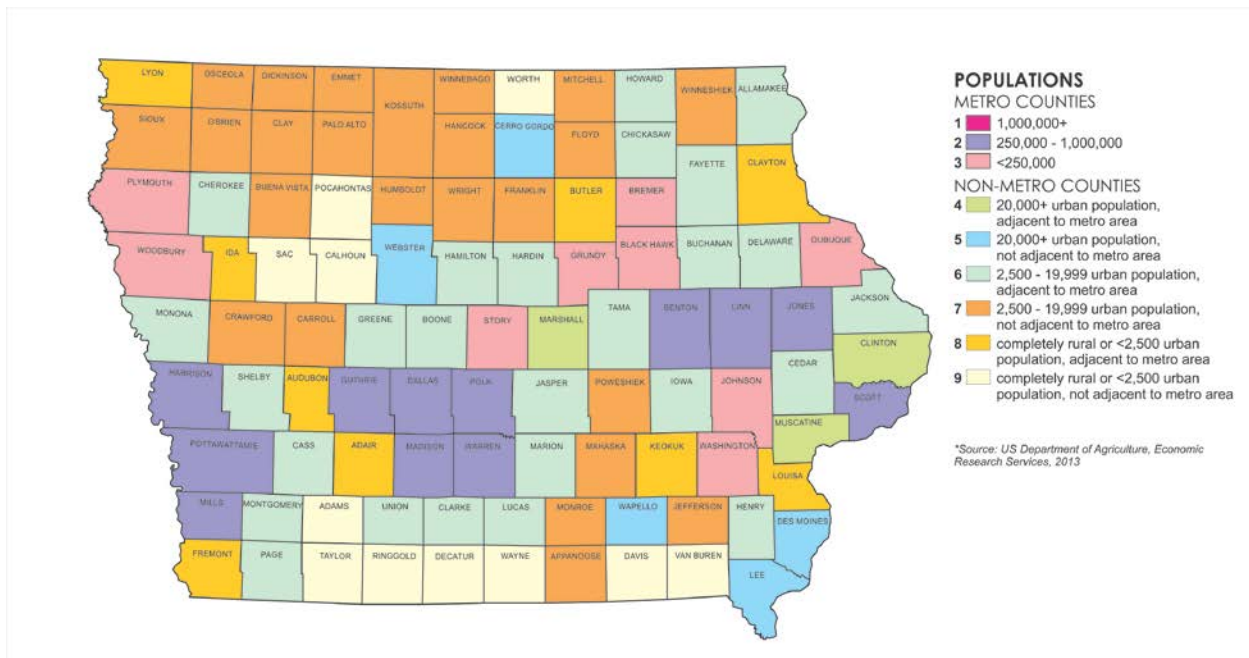


Figure 75. Rural-Urban Continuum Codes (RUCC), Iowa

Iowa has 21 urban counties and 78 rural counties (see Figure 74). Metropolitan areas are based on the federal Office of Management and Budget (OMB) delineation as of February 2013.

Rural codes are not ordinally scaled, with the non-metro county codes alternating between those adjacent and not adjacent to a metro as the codes numerically increase. These codes were first developed in 1974 and updated each decennial. Codes prior to 2000 are not directly comparable to latter-day codes because of methodologic changes made in developing the 2000 metropolitan areas.

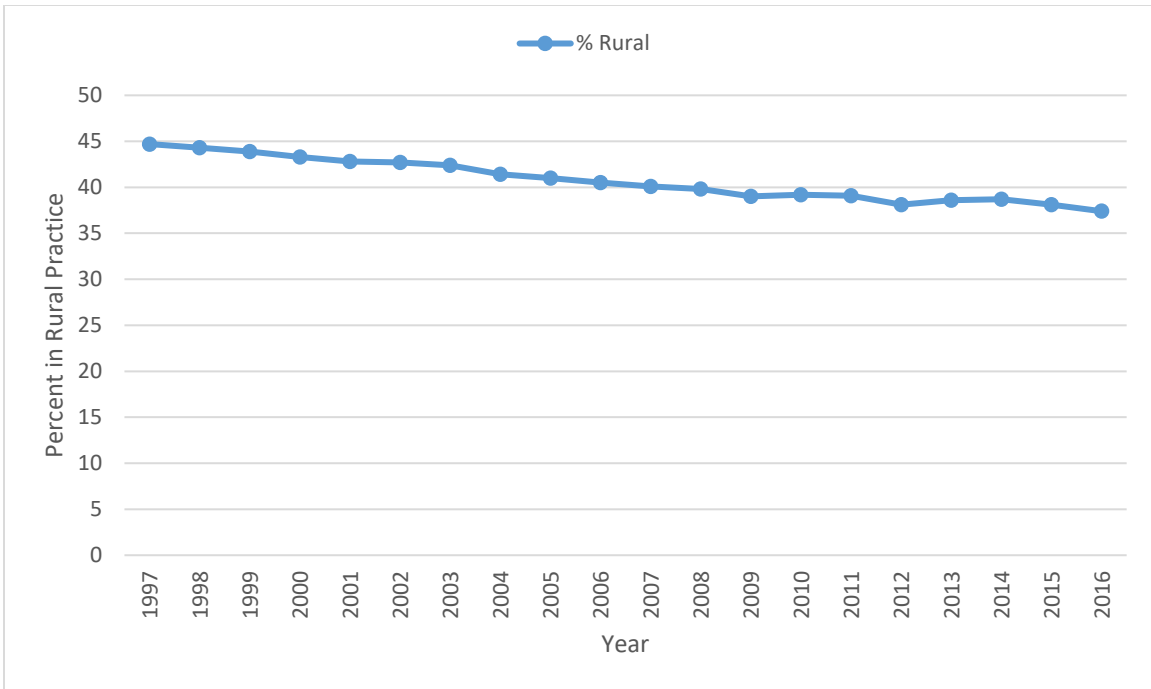


Figure 76. Percent of Iowa dentists in private practice, by rural practice location 1997-2016

There was a decline in the number of private practice dentists who practiced in rural areas from 507 to 424 during this 20-year period coupled with an increase in the number of dentists in urban areas (from 628 in 1997 to a peak of 747 in 2015).

Of all private practice dentists, there was a slow but steady percent decrease from 44.7 in 1997 to 37.4 in 2016.

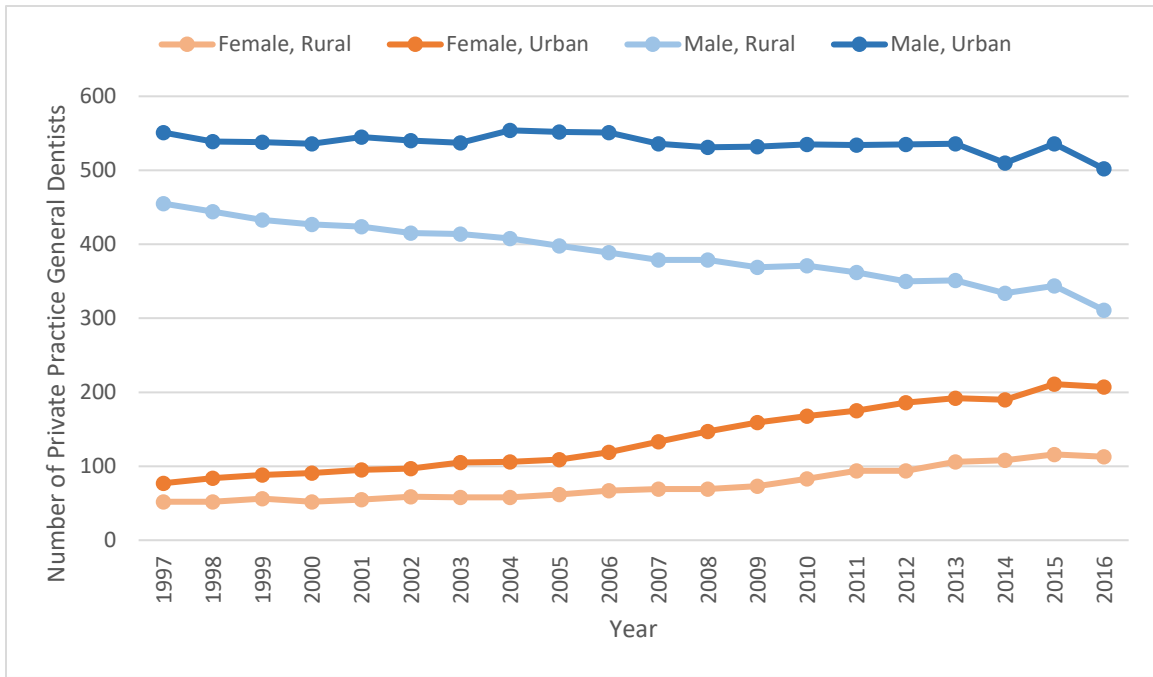


Figure 77. Urban and rural Iowa dentists in private practice, by sex, 1997-2016

The number of males in urban practices peaked at 554 in 2004, with an 8.9% loss by 2016. Similarly, the number of males in rural practices dropped from 455 in 1997 to a low of 311 by 2016, a 31.6% loss.

On the other hand, there was an increase in the number of females in both urban and rural areas. The number of females in urban locations went from 77 in 1997 to a high of 211 in 2015. This translates to an almost 170% increase during this time period. Likewise, females in rural practices rose from 52 to a high of 116 in 2015, a 117% increase during this time. The increase of females in rural areas, however, did not offset the loss of male dentists in rural areas. We should be cautious in overinterpreting this graph because it does not take into account the shift in Iowa's population to more urban centers.

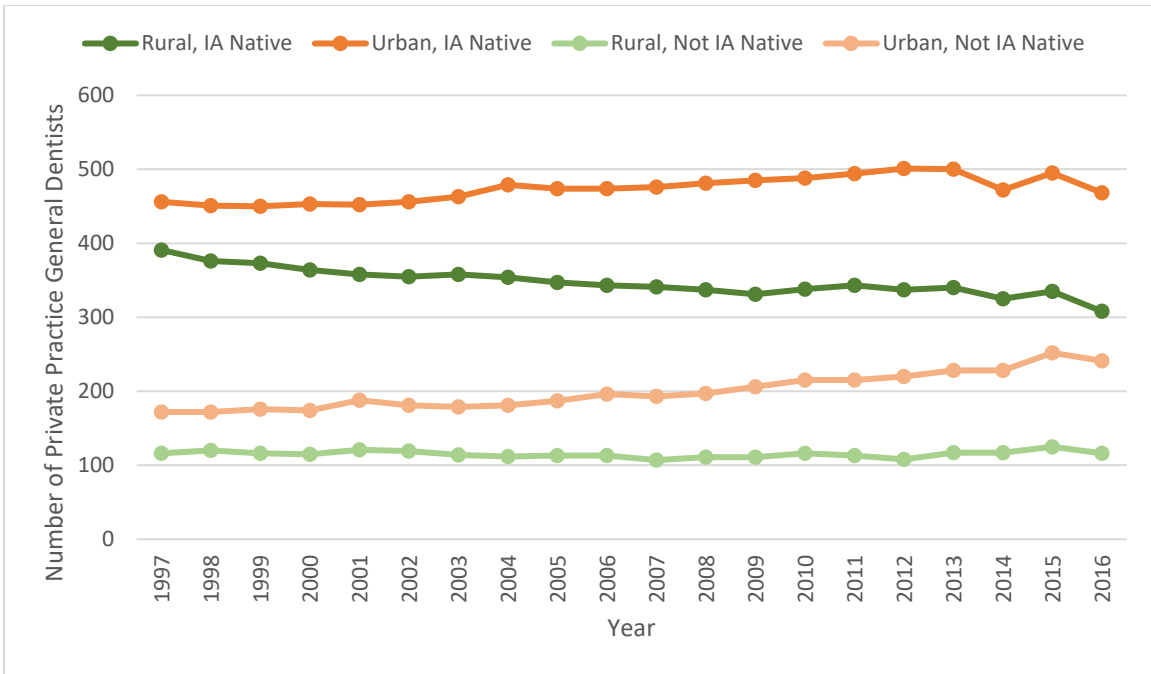


Figure 78. Urban and rural general dentists in private practice, by Iowa nativity, 1997-2016

This graph categorizes general dentists in private practice based on whether they were born in Iowa. Among those born in Iowa, the number of urban practitioners increased from a low of 450 in 1999 to a high of 501 in 2012. The number of Iowa-born dentists who practiced in rural areas decreased from 391 in 1997 to 308 in 2016.

There also was an increase of general dentists from other states found in urban communities, rising from 172 in 1997 to a high of 252 by 2015. Dentists who were born outside of Iowa maintained a steady number in rural practices (between 107 and 125) during these 20 years.

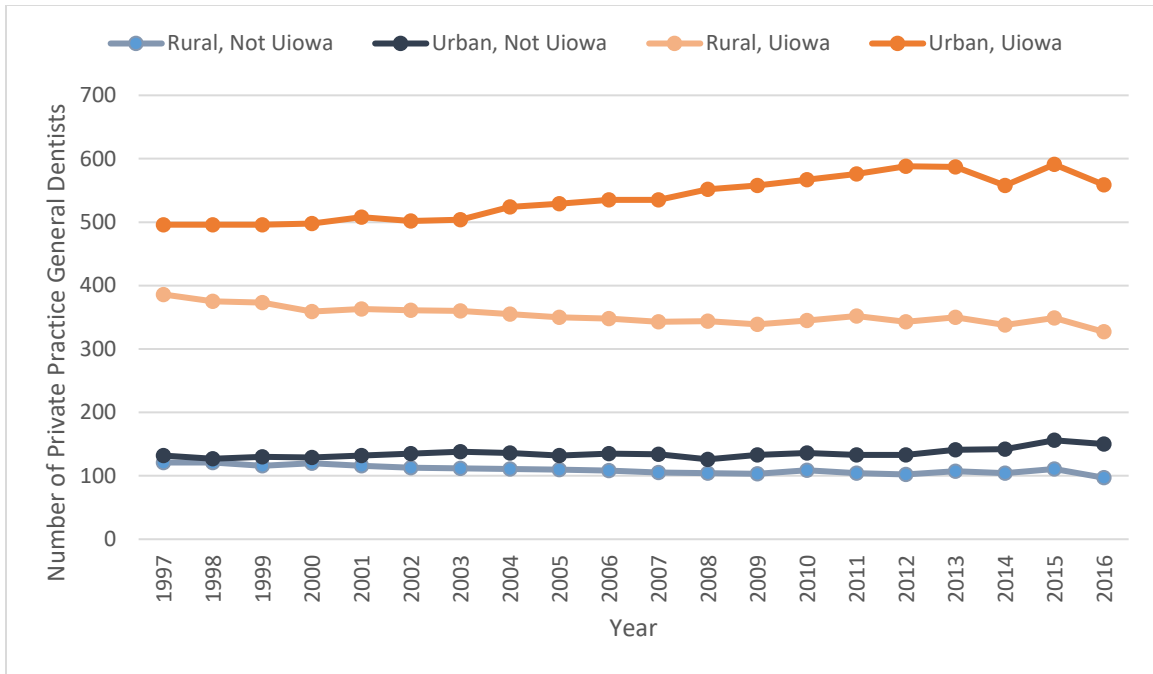


Figure 79. Urban and rural general dentists in private practice, by dental school attended, 1997-2016

This graph displays differences for general dentists in private practice based on whether they graduated from the University of Iowa College of Dentistry. The urban-rural differences were much greater between University of Iowa graduates than those who practiced in Iowa but were educated elsewhere. The number of Iowa graduates who practiced in urban communities rose from 496 in 1997 up to 591 in 2015. In contrast, the number of Iowa graduates in general practice decreased in rural communities from 386 in 1997 to 327 in 2016.

Among those who graduated from other educational institutions, the highest number in urban communities was 156 (in 2015) and the lowest was 126 (in 2008).

There has been a notable decrease in the number of non-Iowa educated dentists during this period who practiced in rural communities, from a high of 121 in 1997 and 1998 to 97 in 2016.

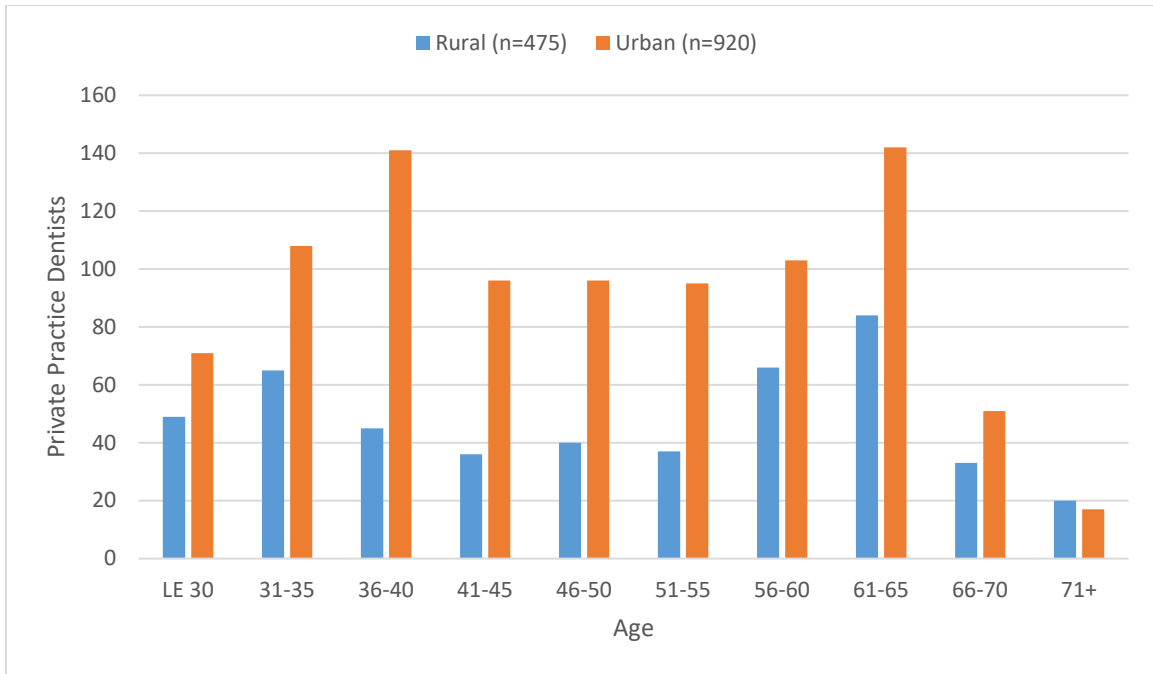


Figure 80. Age of Iowa private practice dentists, by urbanicity, 2016 (N=1,395)

Not surprisingly, for almost all ages the number of active private practitioners in urban locations exceeded that of rural counties. However, the mean age was greater for rural practitioners (49.7 versus 48.1).

In 2016, 34% of private practice dentists worked in rural counties, with the lowest proportions between the ages of 36 through 55.

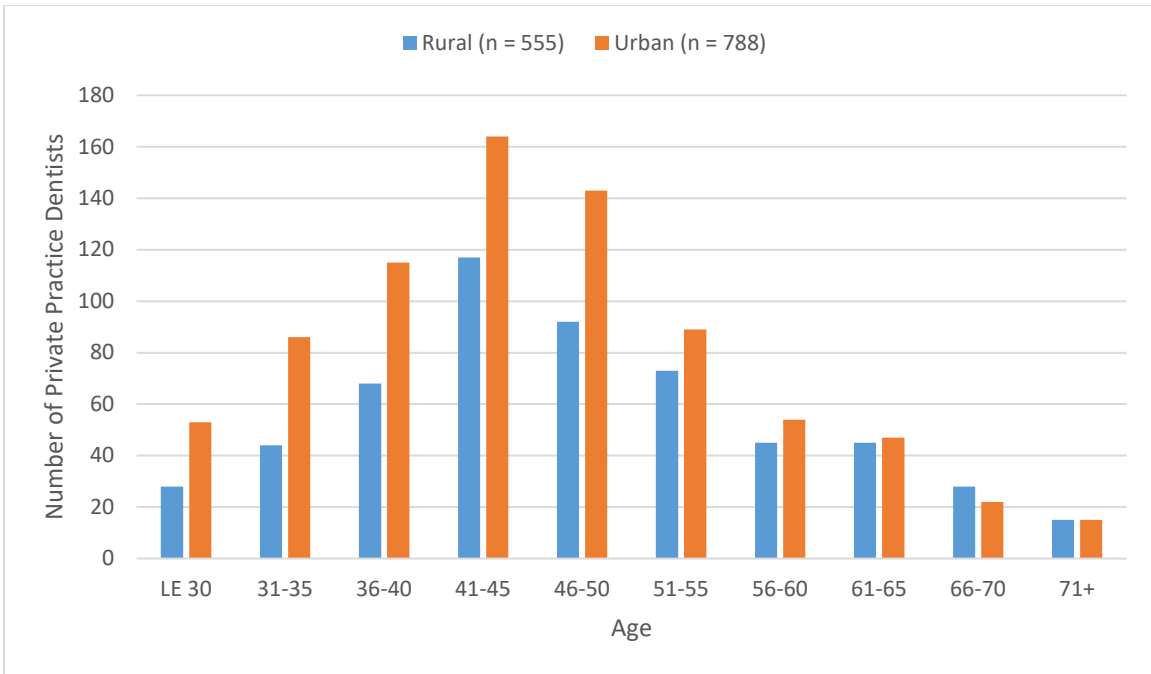


Figure 81. Age of Iowa private practice dentists, by urbanicity, 1997 (N=1,343)

In comparison with data from 2016 (Figure 80), there was a higher proportion of rural dentists for each age group in 1997. Furthermore, the numbers of dentists older than 50 years of age who practice in urban and rural counties were approximately equal.

Graduation Year

There is a high positive correlation between dentist's age and graduation year. However, a small proportion of incoming dental school classes include individuals with some work-related experiences prior to application and enrollment. Thus, we include the following figures for those interested in information based on dentists' graduation years.

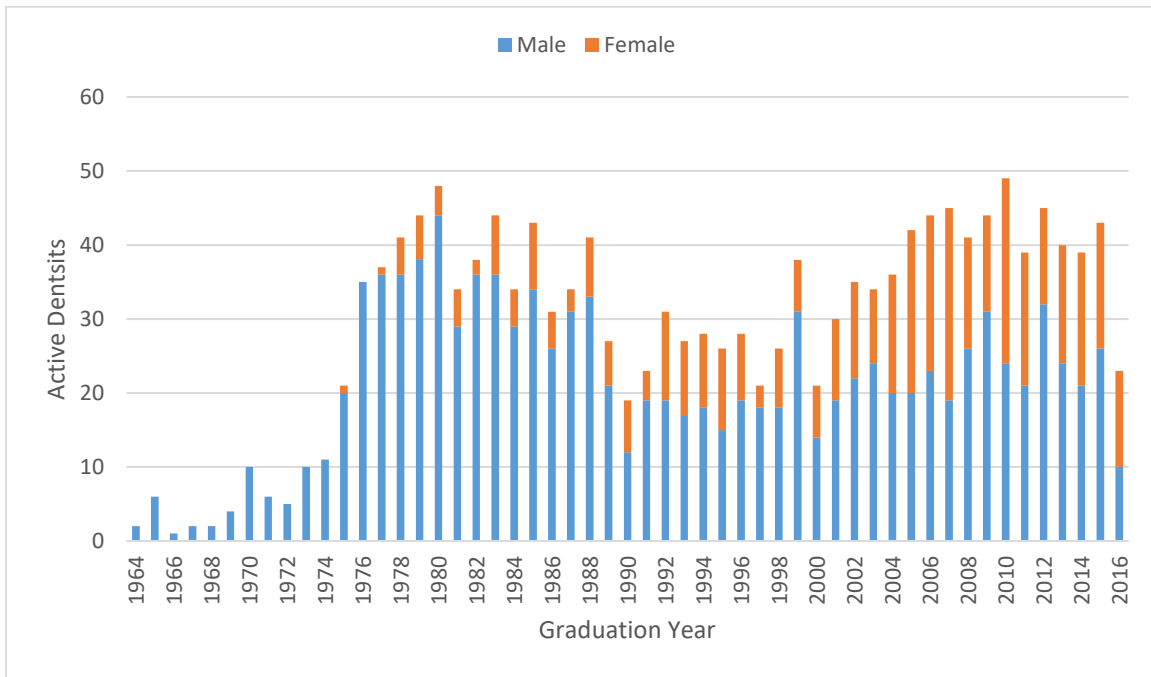


Figure 82. Graduation year for active Iowa dentists, by sex, 2016

Although the largest group of male dentists who practiced in Iowa graduated in 1980 (44), the greatest number of practitioners (49, male and female combined) graduated in 2010.

This figure does not include 2 dentists who graduated prior to 1964.

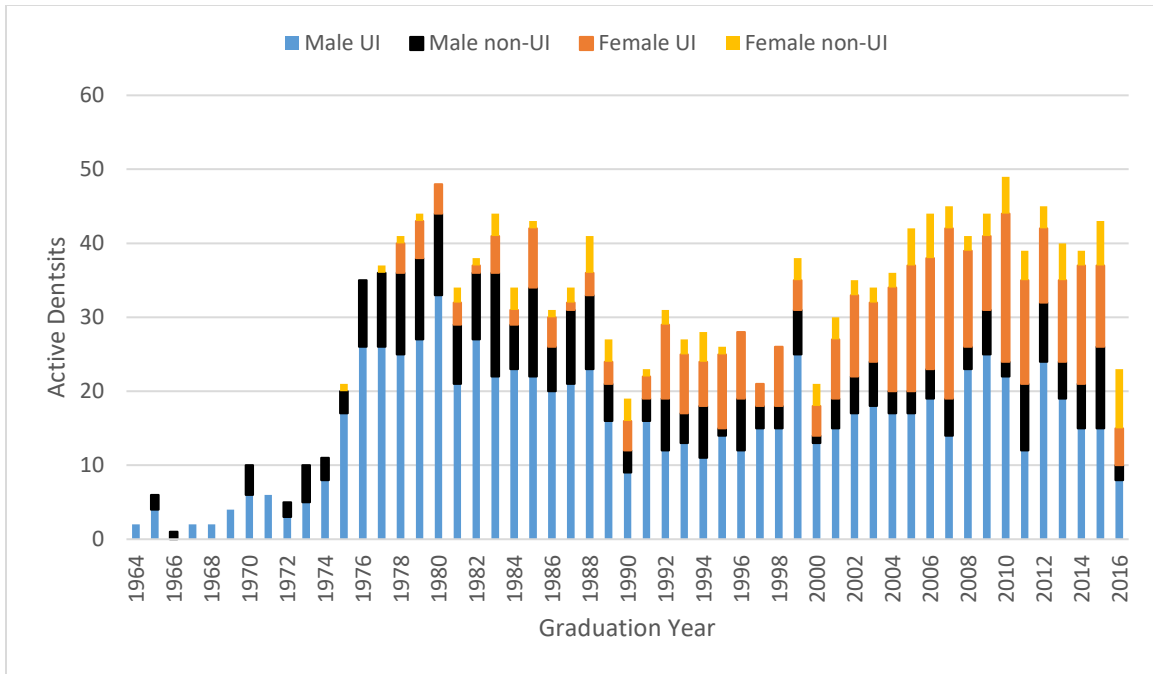


Figure 83. Graduation year for active Iowa dentists, by sex and dental school attended, 2016

For this snapshot view from 2016, the largest number (n=17) of non-University of Iowa graduates who practiced in Iowa graduated in 1983 and 2015. For 5 of the last 6 years of data collection, double-digit numbers of non-University of Iowa graduates have practiced in Iowa. This calls for a more intensive look at this group to determine whether they are shorter term practitioners (i.e., will they practice in Iowa for a relatively brief number of years).

The largest number of graduates (by year) for the 4 groups were:

- Males, University of Iowa: 33 (1980)
- Females, University of Iowa: 23 (2007)
- Males, other dental schools: 14 (1983)
- Females, other dental schools: 8 (2016)

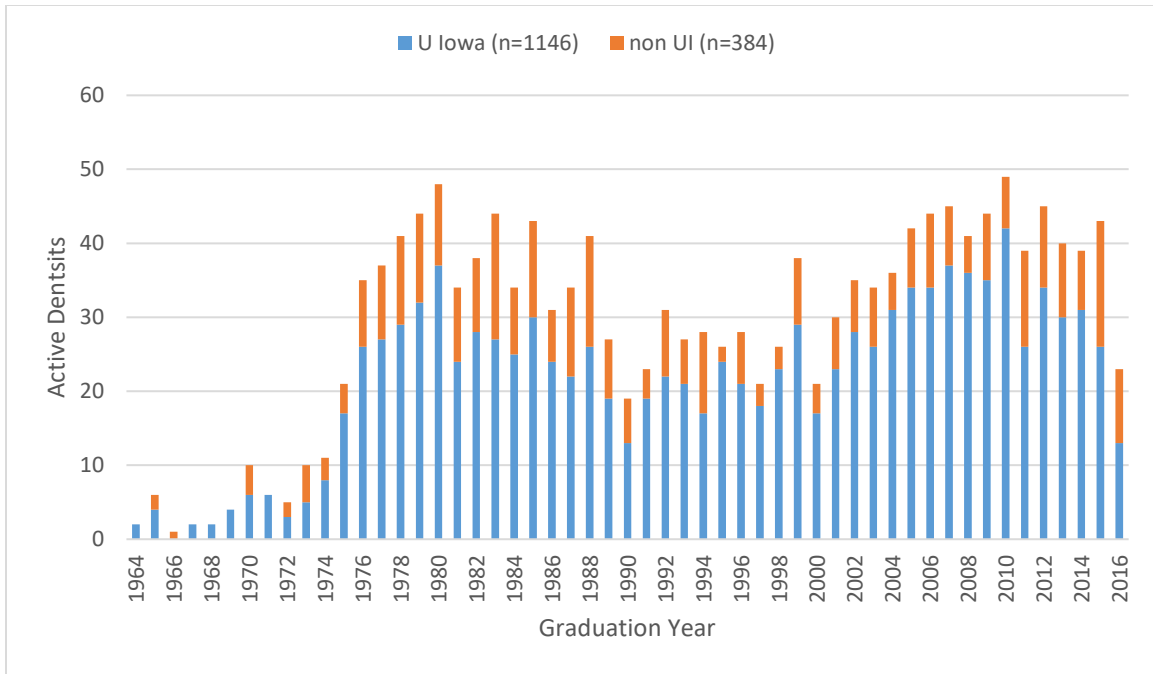


Figure 84. Active Iowa dentists by graduation year, University of Iowa versus other dental schools, 2016

The graduation year with the greatest number of active dentists in Iowa were 2010 for University of Iowa (42 active Iowa dentists) and 1983 and 2015 for other dental schools (17 active Iowa dentists). The number of active Iowa dentists who graduated from dental schools beside University of Iowa was in double-digits between 1977 and 1983.

Impact of the University of Iowa College of Dentistry

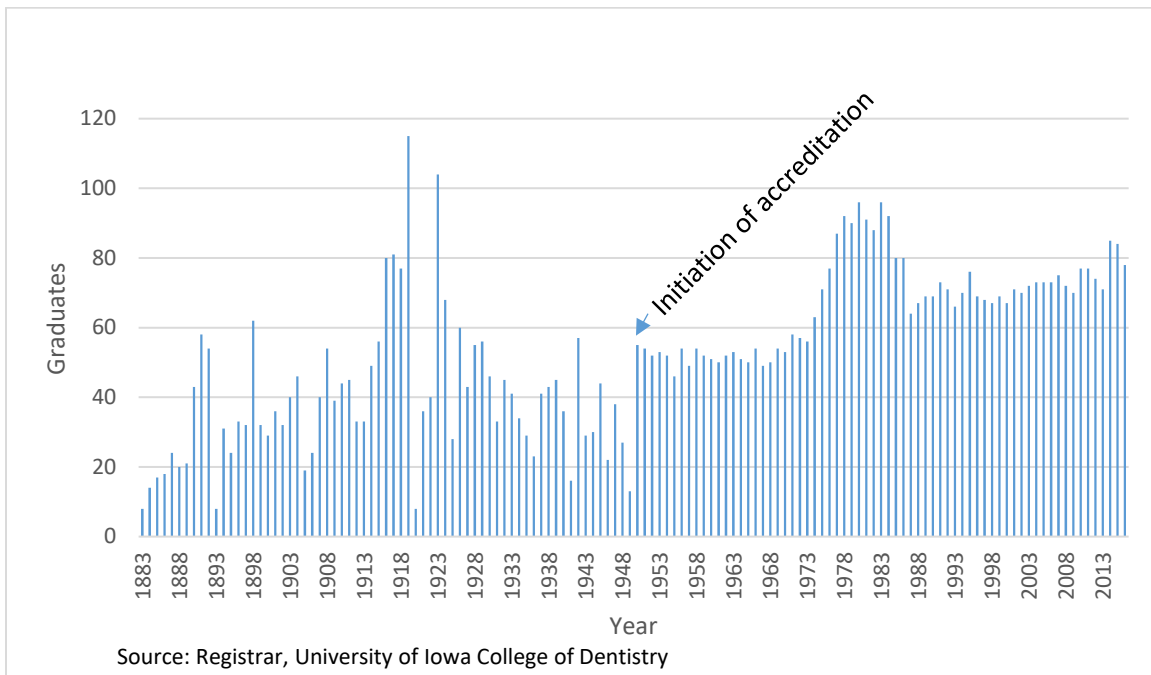


Figure 85. Number of University of Iowa College of Dentistry graduates, 1883-2016

The highest number of University of Iowa College of Dentistry graduates was in 1919, when there were 115 graduates, followed the next year with a tie for the lowest number (8), which also occurred in 1883 and 1893.

Until the introduction of a national accreditation standard, the annual number of graduates varied greatly. Thereafter, increases and decreases have been more gradual. The exception is the spike in the 1970s and early 1980s, which was based on national projections that there would a great need for physicians and dentists. All but one dental school in the country opted to increase their class size in exchange for federal funds to build new facilities.

Interestingly, the recession of the 1980s led to a cry from within the profession to reduce the number of graduates. Nationally, this was a period when several institutions discontinued their dental programs. The University of Iowa, like many other dental schools, reduced its class size.

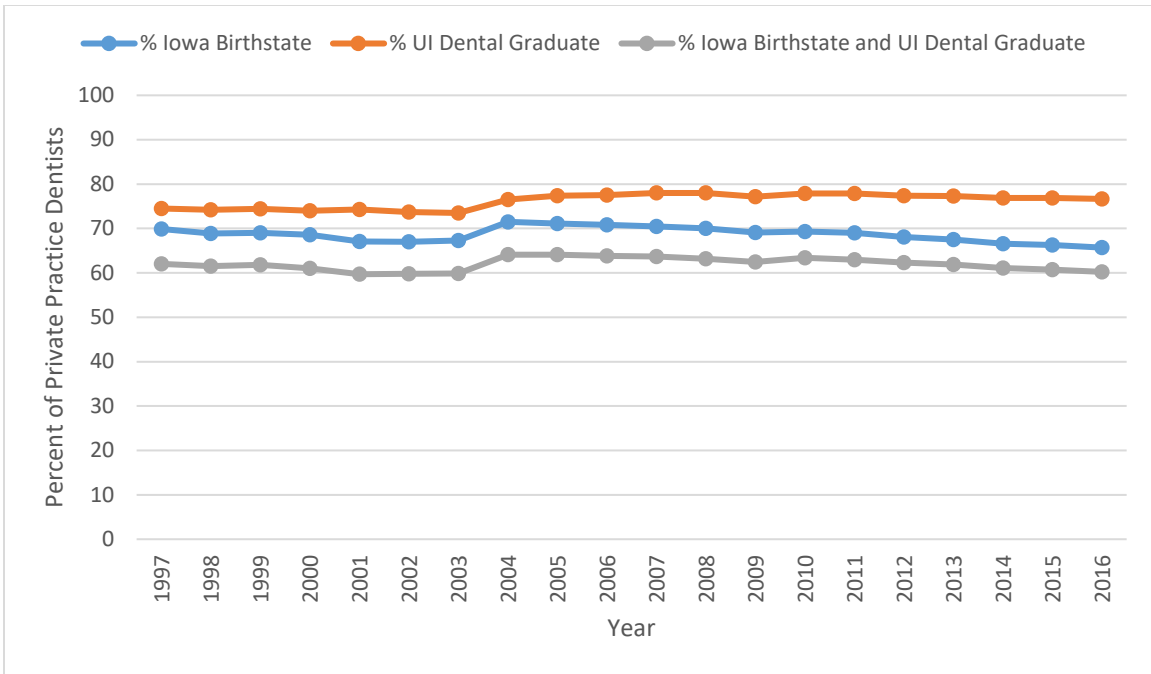


Figure 86. Annual percent of Iowa private practice dentists who are University of Iowa graduates (1997-2016) and/or born in Iowa, 2016

Between 73 and 78 percent of Iowa’s dentists were graduates of the University of Iowa College of Dentistry throughout this time period. A slightly smaller percentage of active Iowa dentists were native, ranging from 65.7% to 71.5%.

The percent of Iowa’s dentists who were born in the state and graduated from the University of Iowa College of Dentistry ranged from a low of 58.7% in 2001 to 64.1% in both 2004 and 2005.

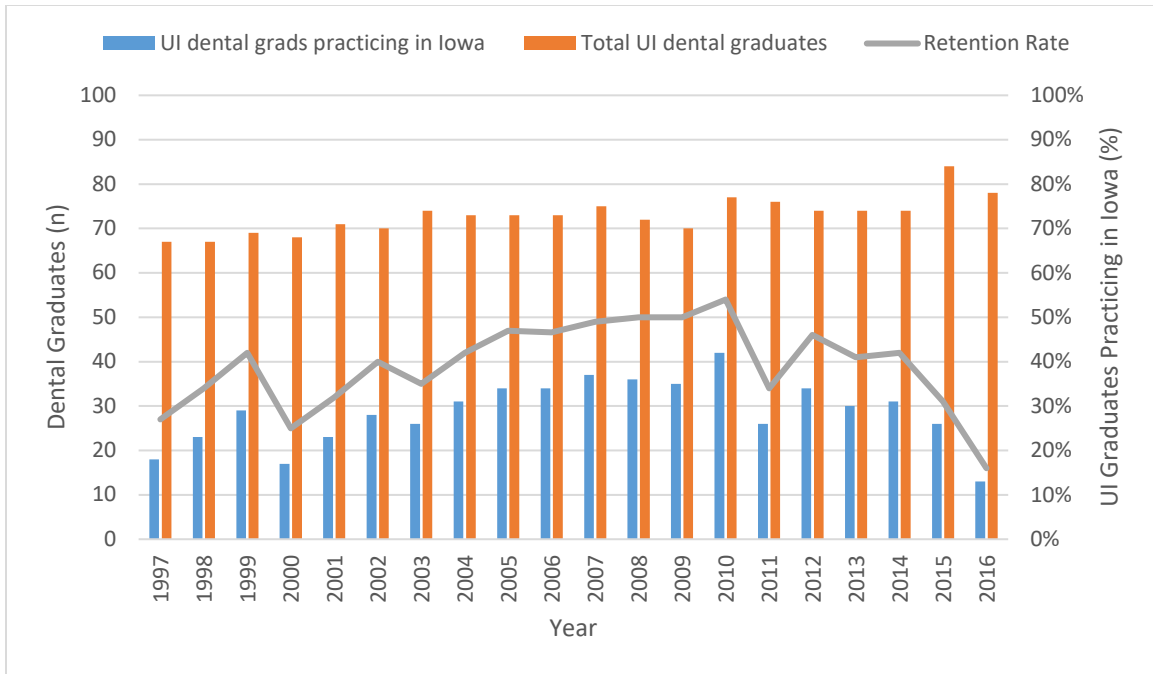


Figure 87. University of Iowa graduates (1997-2016) who were practicing in Iowa in 2016, by graduation year

Historically, there is a lower retention rate for approximately the first 5 years beyond dental school graduation. This is due, in part, because of the limited number of specialty training slots in the state and other immediate commitments (e.g., military obligation). Thus, we present 2 low end figures, one for the entire 20 years and another that discounts the period 2011 through 2016.

For those graduating from the University of Iowa College of Dentistry between 1997 and 2016, the class of 2010 had the most graduates (42) who practice in Iowa. The lowest number is the class of 2016, which only had 13 immediately go into practice in Iowa. When excluding the last few years, the lowest number was from the class of 2000, which had 17 members remain in Iowa.

Retention rates ranged from a high of 54% (class of 2010), to a low of 16% (class of 2016). If one looks only to those classes prior to 2011, the class of 2000 had the lowest percent (25%) who practiced in Iowa.

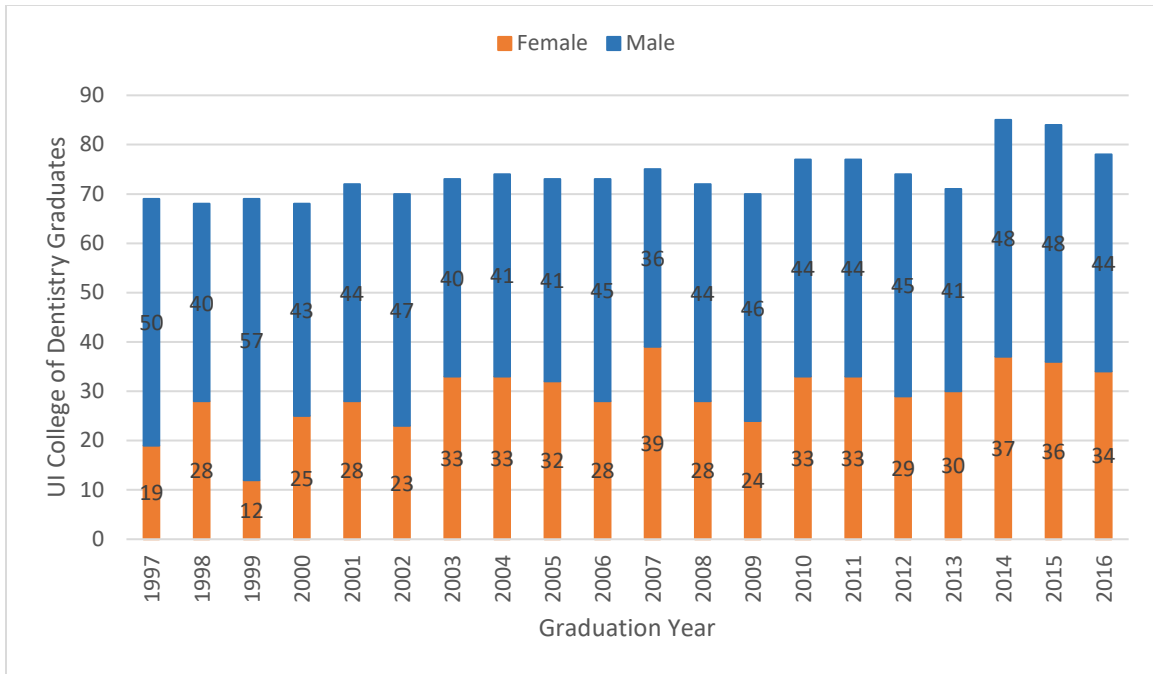


Figure 88. Number of University of Iowa College of Dentistry graduates (1997-2016), by sex

For several years, the number of each graduating class was approximately 70-72 students. In recent years, the College of Dentistry has slightly increased the class size.

There was only one graduating class (2007) in which the number of females exceeded males.

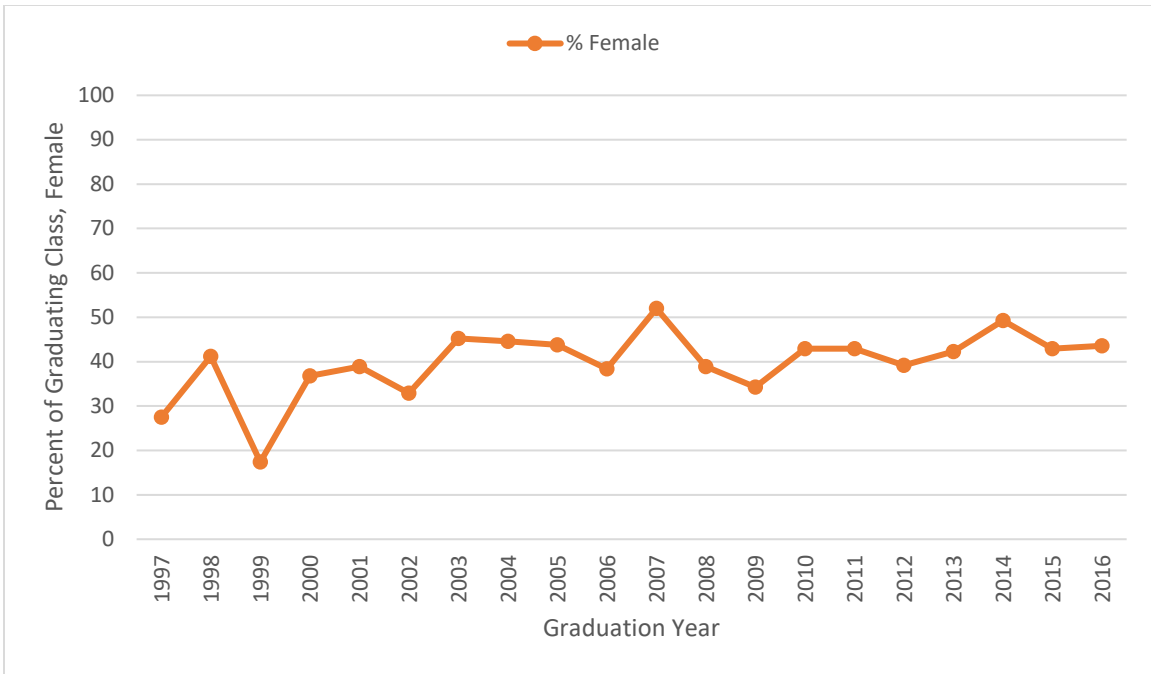


Figure 89. Percent of University of Iowa College of Dentistry graduating class (1997-2016) who were female

The percent of the University of Iowa graduating class who were female ranged from a low of 17.4% (1999) to a high of 52% (2007). In addition, the most recent graduation class (2017) had equal percentages of male and female graduates.

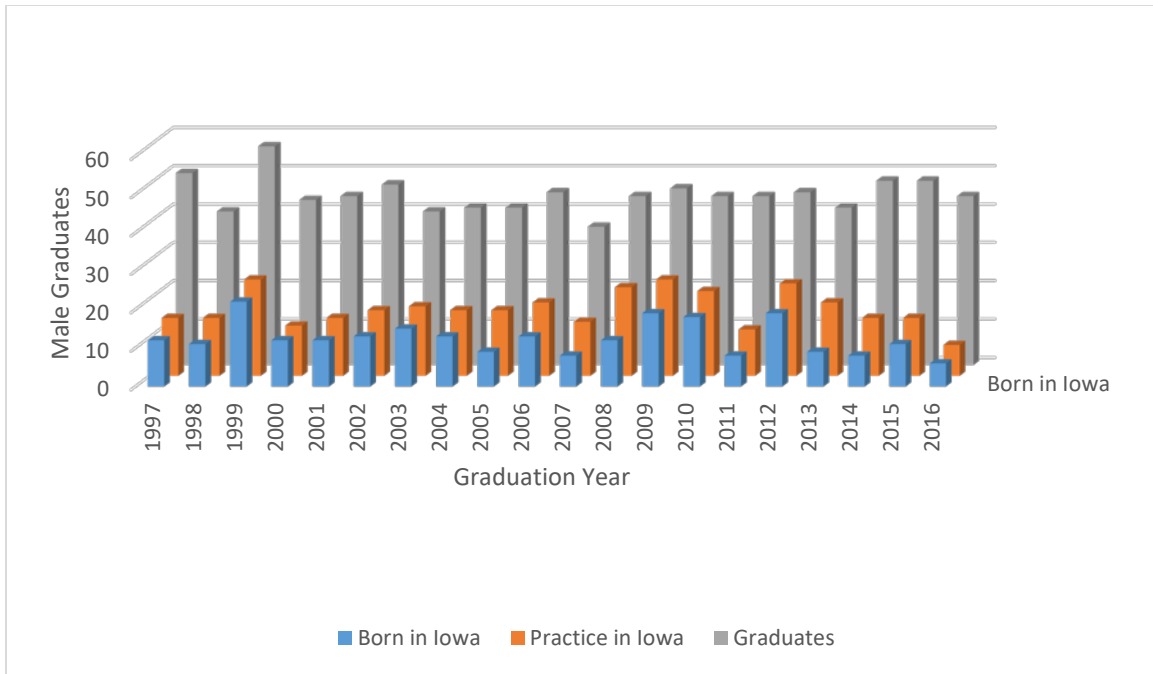


Figure 90. Number of male University of Iowa College of Dentistry graduates (1997-2016) who practice in Iowa and born in the state, 2016

During this 20-year period, the class of 1999 from the University of Iowa had the most male graduates (57) and the class of 2007 had the fewest (36). There was a tie for the greatest number of active practitioners between the classes of 1999 and 2009 with 25 each. Understandably, the class of 2016 had the fewest active practitioners at 8 males.

There was a tie for the largest number of male dentists who were born in Iowa between the classes of 2008 and 2012, with 19 each. The lowest number was again from the class of 2016, with 6 graduates born in Iowa.

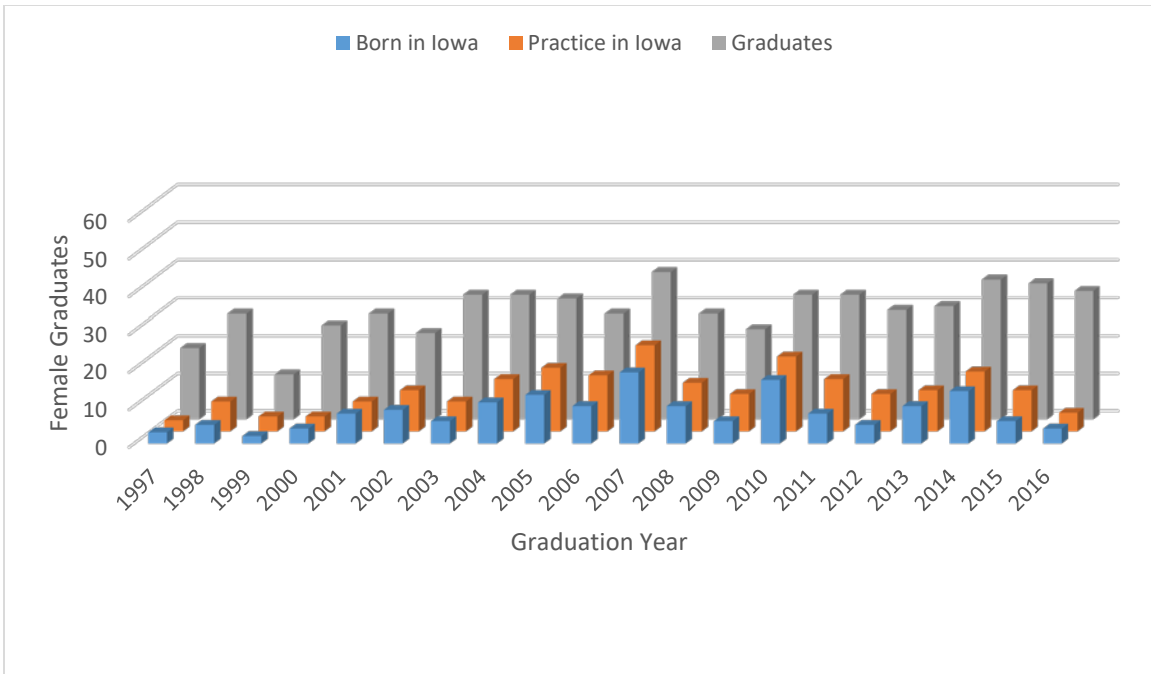


Figure 91. Number of female University of Iowa College of Dentistry graduates (1997-2016) who practice in Iowa and were born in the state, 2016

The class of 2007 had the greatest number of female graduates (39) and the class of 1999 had the fewest female graduates (12). The largest number (23) of active female Iowa practitioners were from the class of 2007 and the lowest (3) were from the class of 1999.

Likewise, the largest number of female dentists born in Iowa were in the class of 2007 (19) and the lowest number (2) were in the class of 1999.

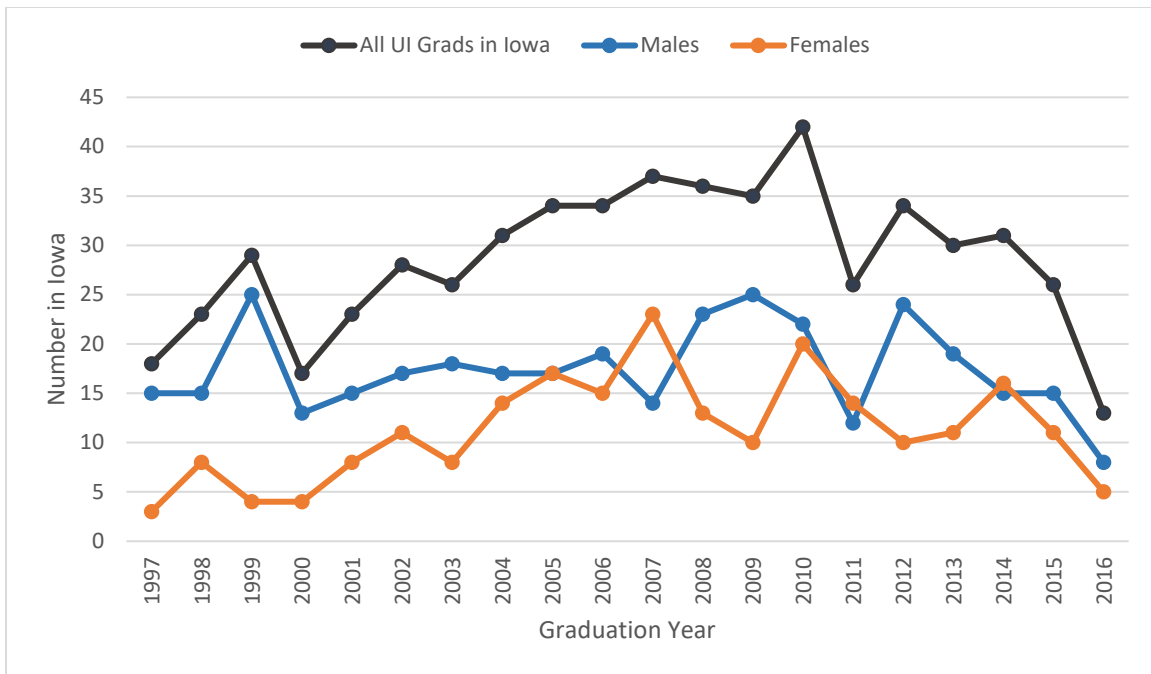


Figure 92. Number of University of Iowa College of Dentistry graduates (1997-2016) practicing in Iowa, by sex, 2016

Between 1997 and 2016, 537 University of Iowa graduates practiced in Iowa.

There is a lag time before many dental school graduates eventually select a permanent practice location due to such issues as additional education, military obligations, spousal education, and educational debt. (Some feel that there may be a 5-year time period between graduation and when a dentist “settles down” in a practice location).

The class with the greatest number of active Iowa dentists was 2010, with 42, and the lowest was the class of 2000, with 17. For males, the greatest number (25) was a tie between the classes of 1999 and 2009 and the lowest number (12) was the class of 2011. For females, the greatest number (23) was the class of 2007 and the lowest (3) was the class of 1997.

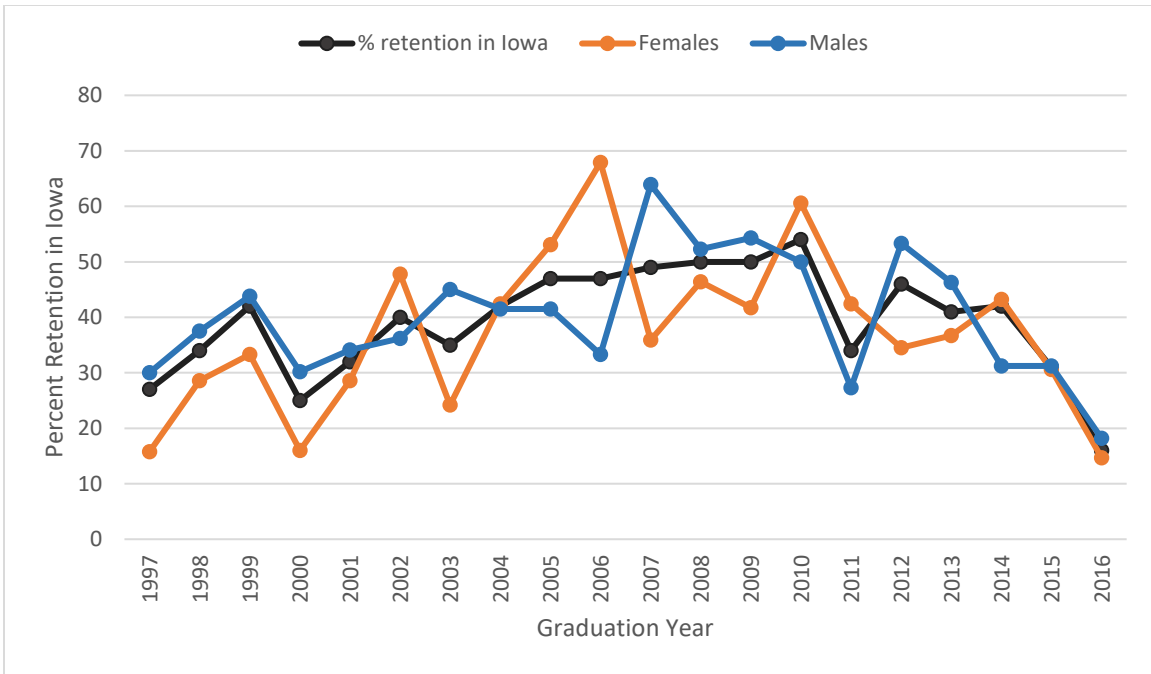


Figure 93. Percent of University of Iowa College of Dentistry graduates (1997-2016) practicing in Iowa, by sex, 2016

This figure accompanies the preceding one. The average retention rate for female and male dentists is 37.7% and 39.8%, respectively. Once again, there is generally a 5-year lag before many graduates return from other obligations (e.g., advanced training, military) to Iowa.

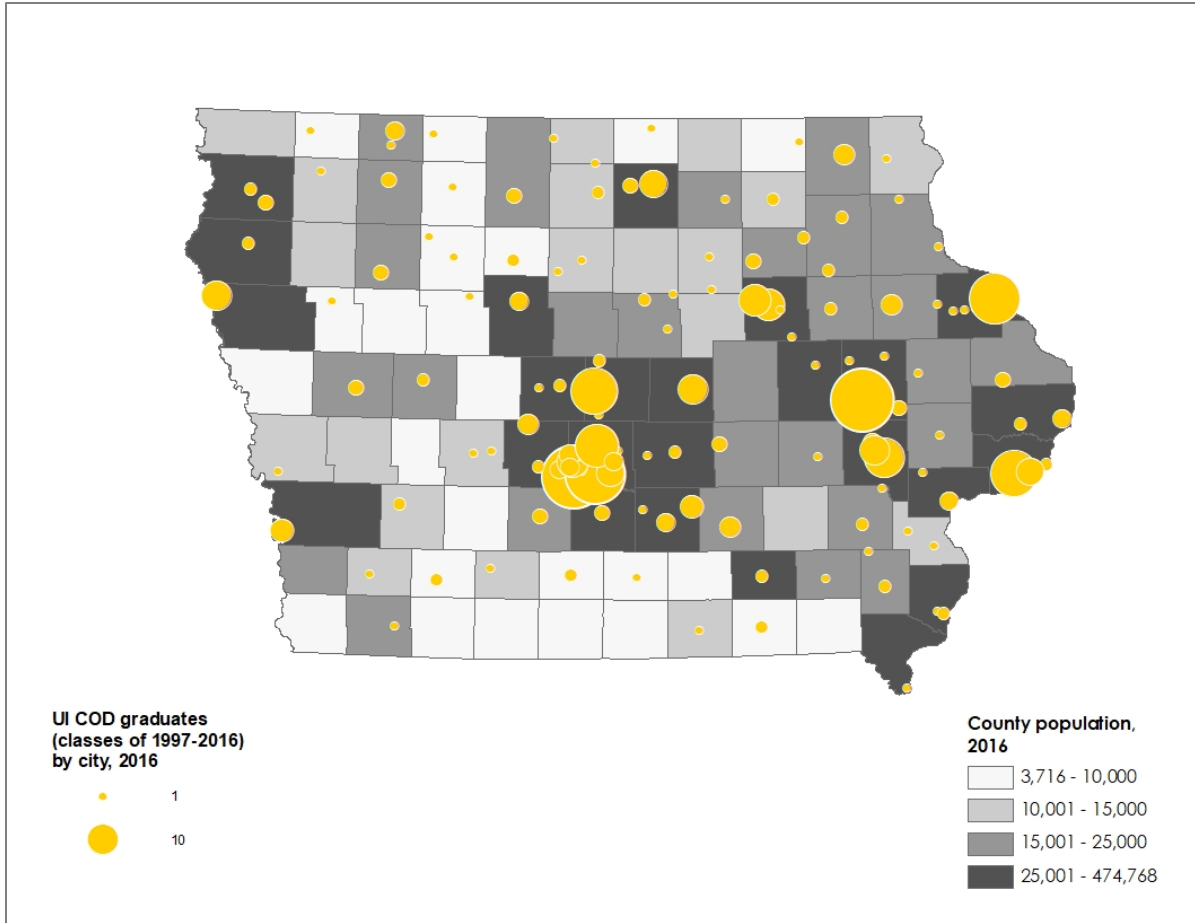


Figure 94. Location of University of Iowa College of Dentistry graduates (1997-2016) in private practice, 2016

This figure displays the location of private practice dentists who graduated from the University of Iowa College of Dentistry from 1997 through 2016 only. The size of the circles represents the relative number of dentists in a community. Each county is categorized into one of 4 groups based on population size. The darker the shade of the county, the more heavily populated the county in 2016.

Hours Worked Per Week

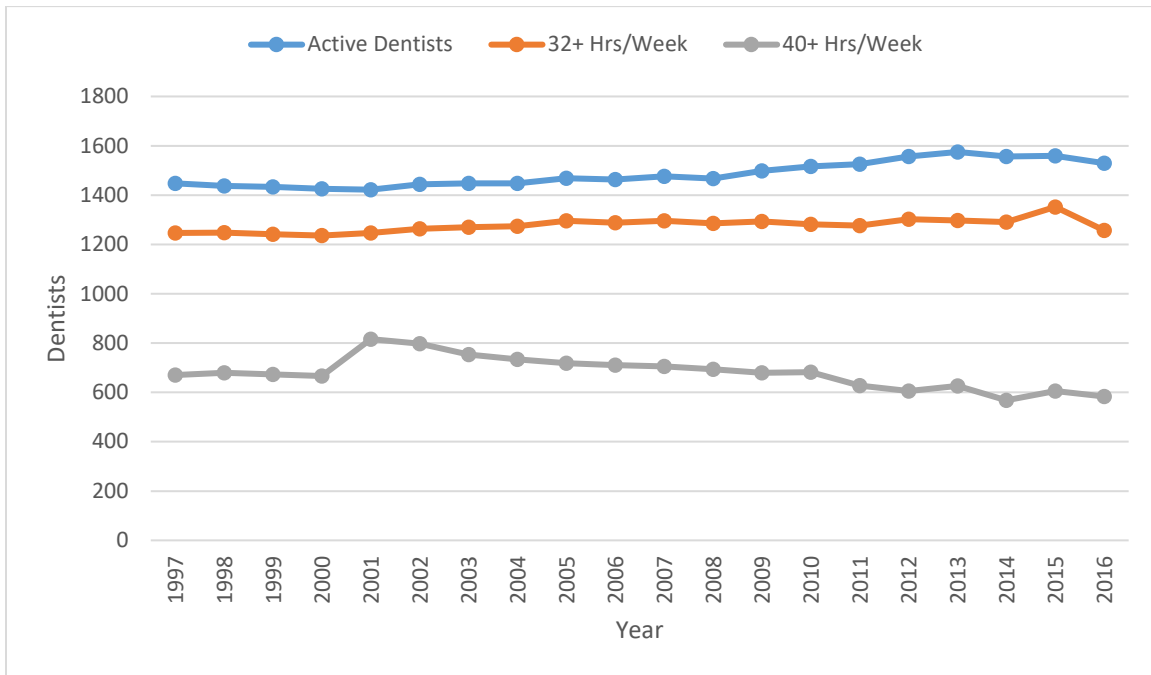


Figure 95. Hours worked per week, on average, for all active Iowa dentists, 1997-2016

Between 1997 and 2000, there was a steady number of active dentists who worked 40 or more hours per week. Then, this number increased considerably at about the same time as the dot-com economic bubble. Subsequently, the number of active Iowa dentists who worked 40 or more hours per week, on average, decreased from 816 (2001) to 568 (2014), a decrease of 30%. The percent of dentists who worked 32 hours or more per week remained fairly consistent relative to the total number of dentists through 2008. After that date, there was a slight divergence between the two lines.

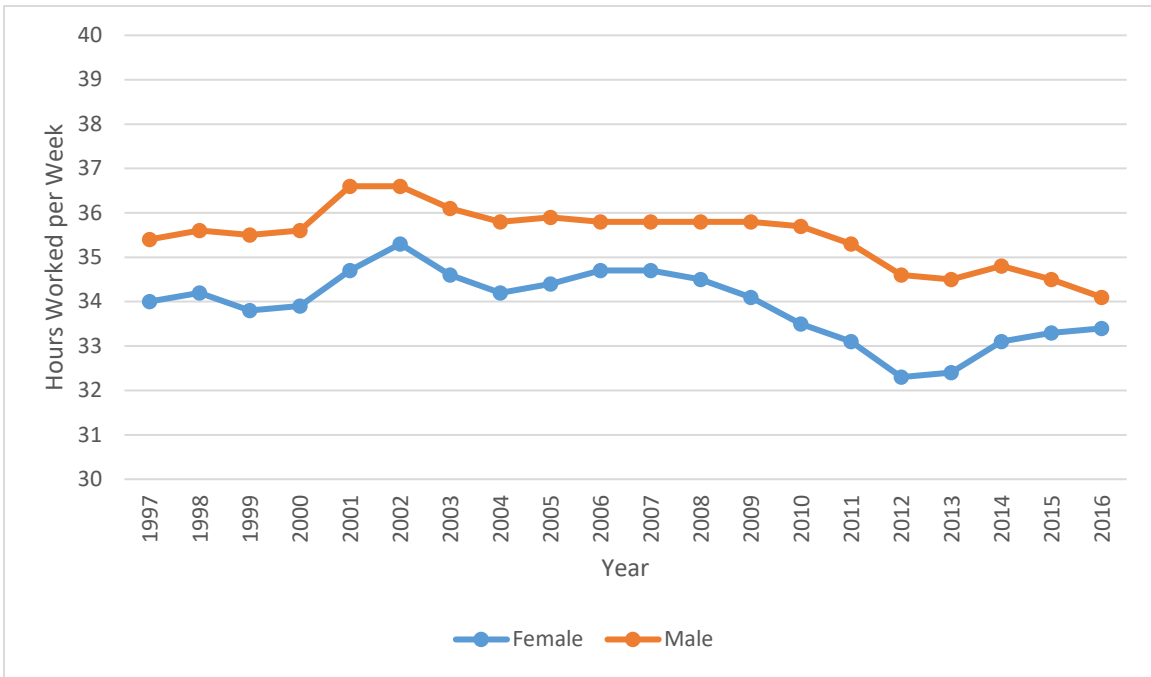


Figure 96. Hours worked per week, on average, all active Iowa dentists, by sex, 1997-2016

Among all active Iowa dentists, males worked more hours per week, on average, than female dentists. On average, males worked between 34.1 hours per week (2016) and 36.6 (2001 and 2002), while female dentists worked between 32.3 hours per week (2012) and 36.6 (2002).

Note that number of hours worked per week starts at 30 on the y-axis for this figure and several of the following figures.

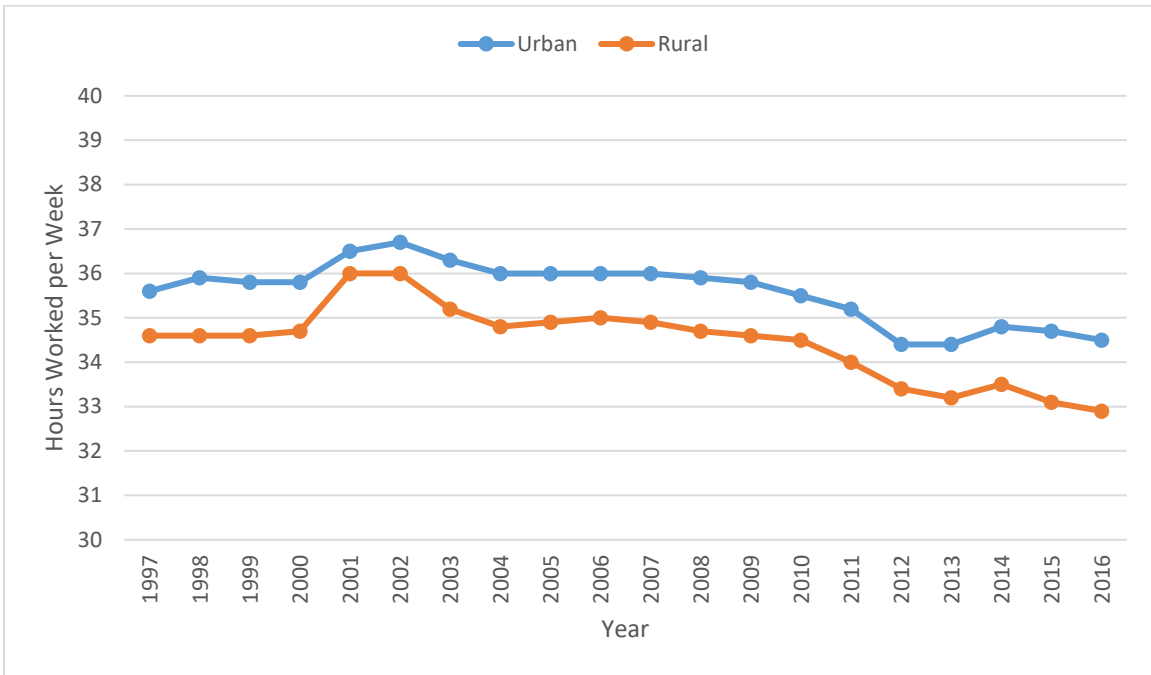


Figure 97. Hours worked per week, on average, by all active Iowa dentists, urban versus rural, 1997-2016

Among all active Iowa dentists, urban dentists worked slightly more hours per week than their rural colleagues. The range of hours per week among urban dentists was between 34.4 (2012 and 2013) and 36.7 (2002). Among rural dentists, hours per week, on average, ranged between 32.9 (2016) and 36.0 (2001).

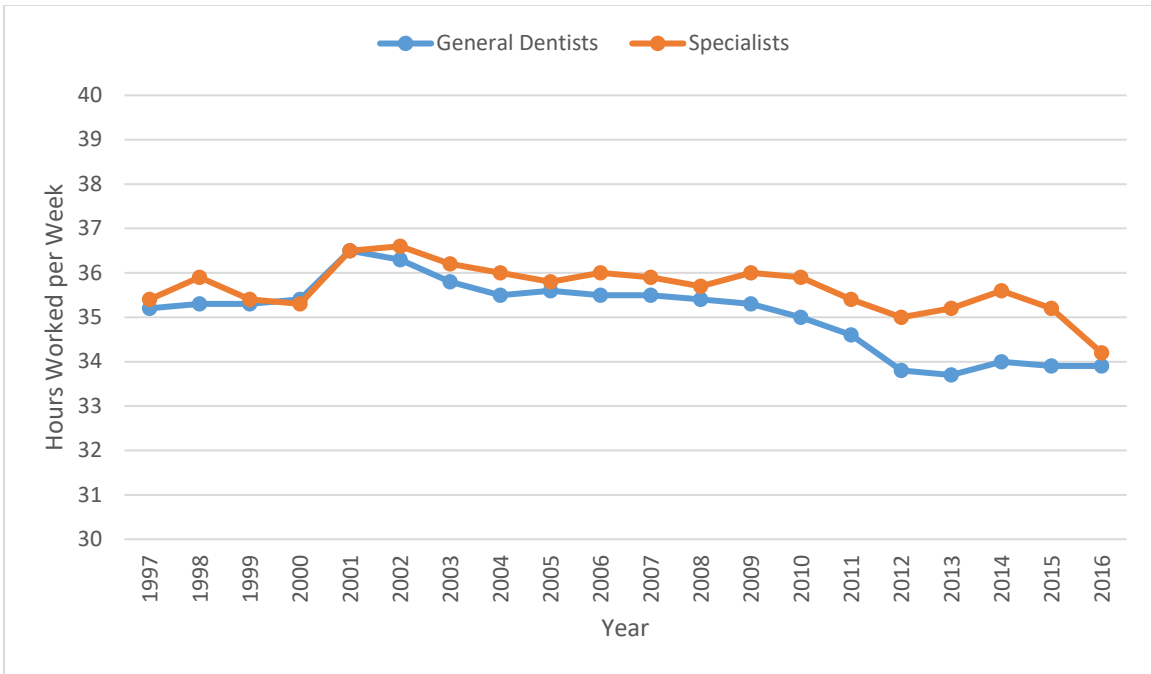


Figure 98. Hours worked per week, on average, by all active Iowa dentists, general dentists versus specialists, 1997-2016

Irrespective of practice activity, dental specialists worked slightly more hours per week than general dentists. General dentist hours per week ranged from 33.7 (2013) to 36.5 (2001), whereas hours worked per week by dental specialists ranged from 34.2 (2016) to 36.6 (2002).

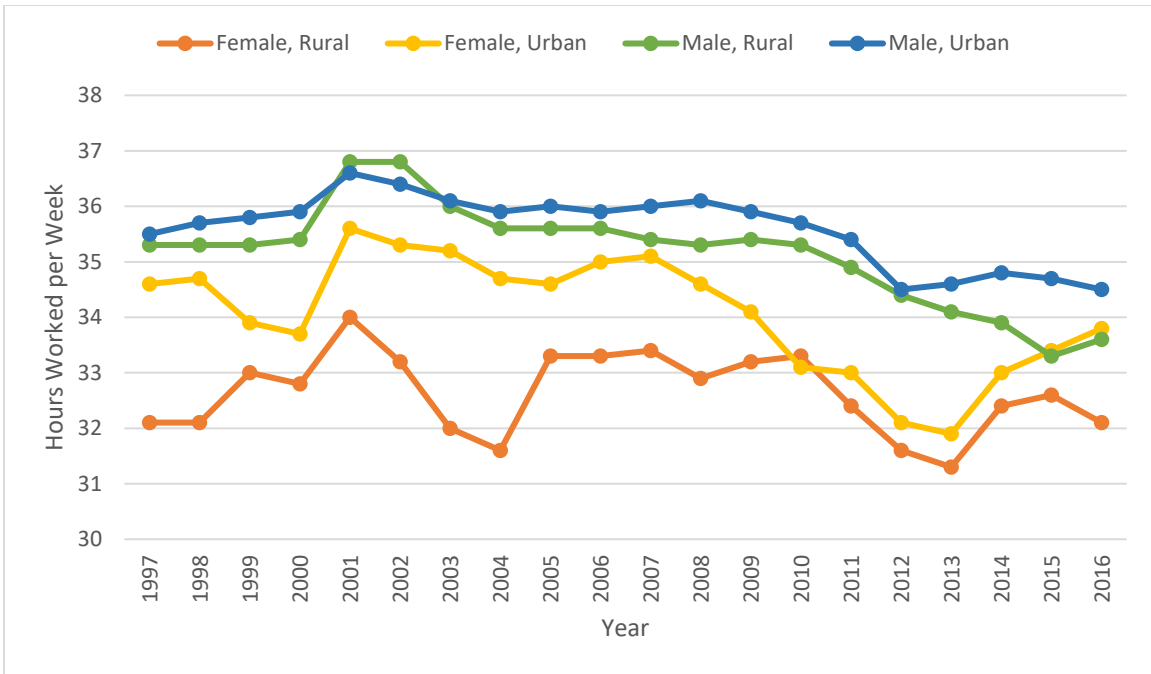


Figure 99. Hours worked per week, on average, by all active Iowa general dentists, by sex and location, 1997-2016

Male general dentists worked more hours per week, on average, than females, regardless of practice location. With a few exceptions, urban dentists of either sex worked more hours per week, on average, than rural general dentists.

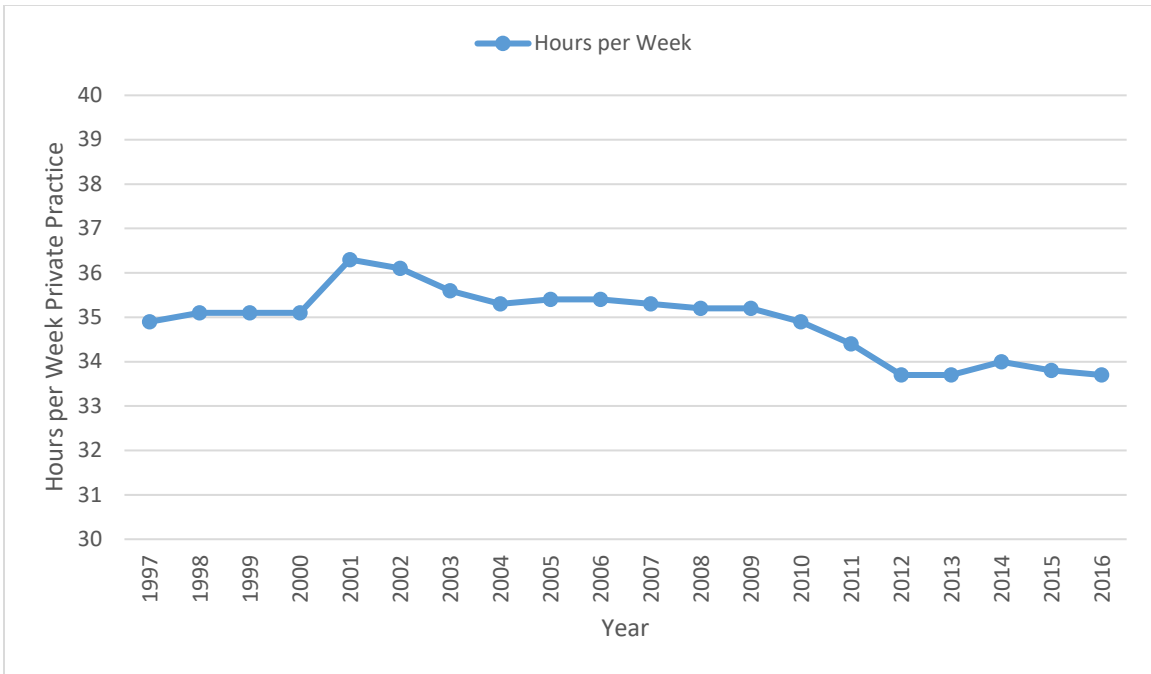


Figure 100. Mean hours per week for Iowa private practice dentists, 1997-2016

After a slight increase in the mean number of hours at the turn of the century, there has been a very gradual decline in the mean number of hours worked by Iowa private practice dentists. During the last 5 years of this review private practice dentists worked, on average, 34.0 hours or less per week.

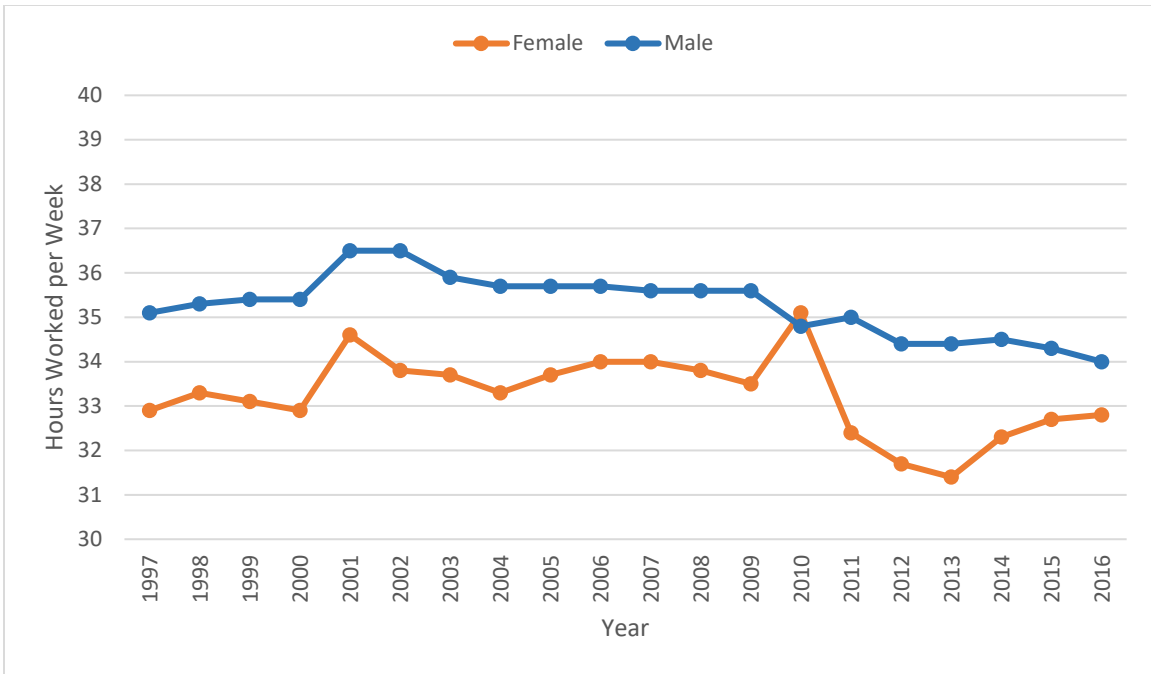


Figure 101. Hours worked per week, on average, by private practice Iowa dentists, by sex, 1997-2016

Except in 2010, male private practice dentists consistently worked a higher average of hours per week than females. For males, hours per week ranged from 34 (2016) to 36.5 (2001). Among female private practitioners, hours per week ranged from 31.4 (2013) to 35.1 (2010).

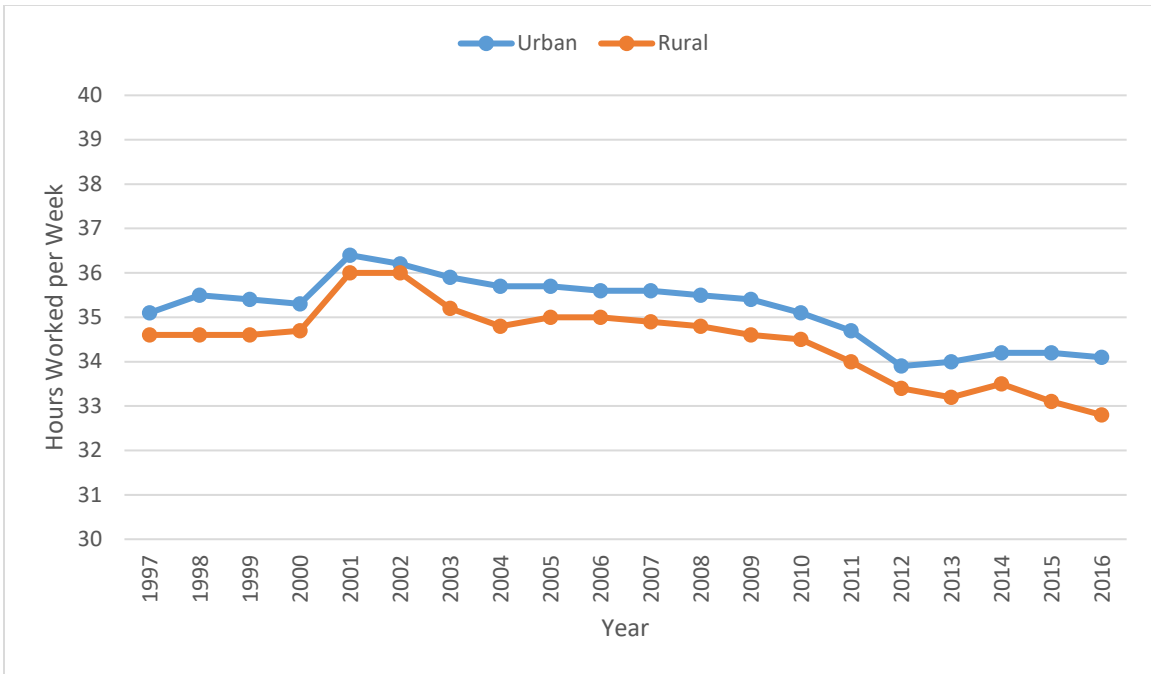


Figure 102. Hours worked per week, on average, by private practice Iowa dentists, by urbanicity, 1997-2016

Urban, private practice dentists consistently worked slightly more hours per week than their rural colleagues. For urban dentists, the range was from an average of 33.9 hours per week in 2012 to 36.4 hours in 2001. Among rural dentists, hours per week ranged from 32.8 (2016) to 36.0 (2001).

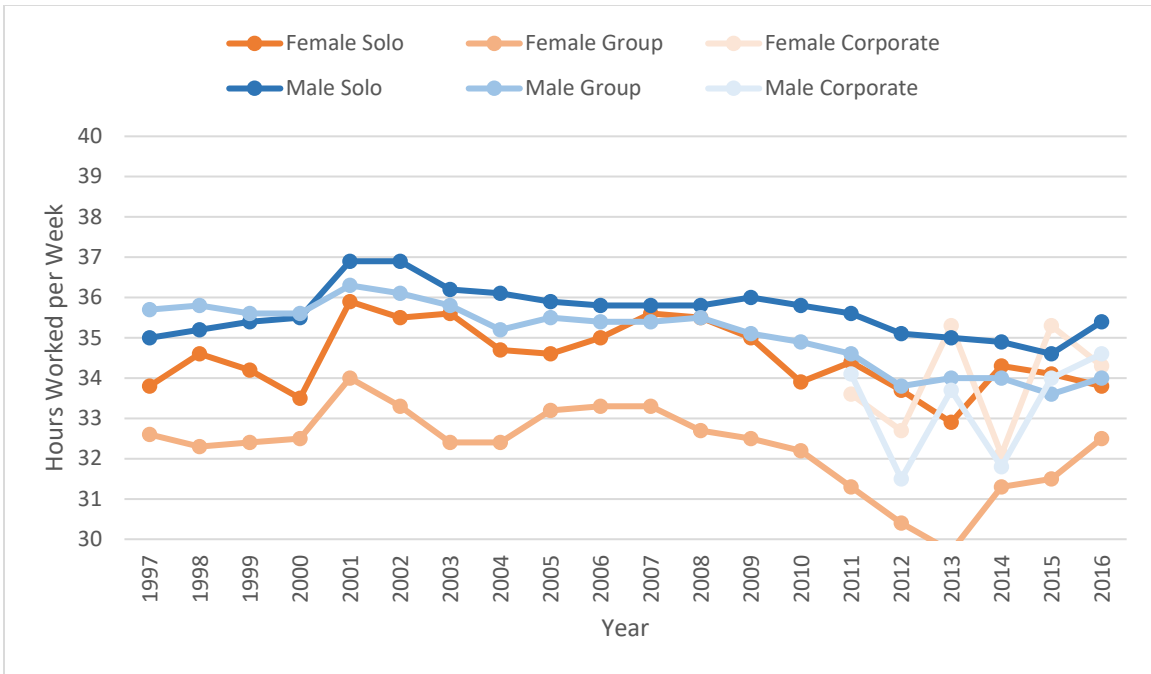


Figure 103. Hours worked per week, on average, by private practice general dentists, by sex and practice arrangement, 1997-2016

Among general dentists in private practice, males in solo practice generally worked more hours per week than any other practice arrangement. Female general dentists in group practice consistently worked the fewest hours on average.

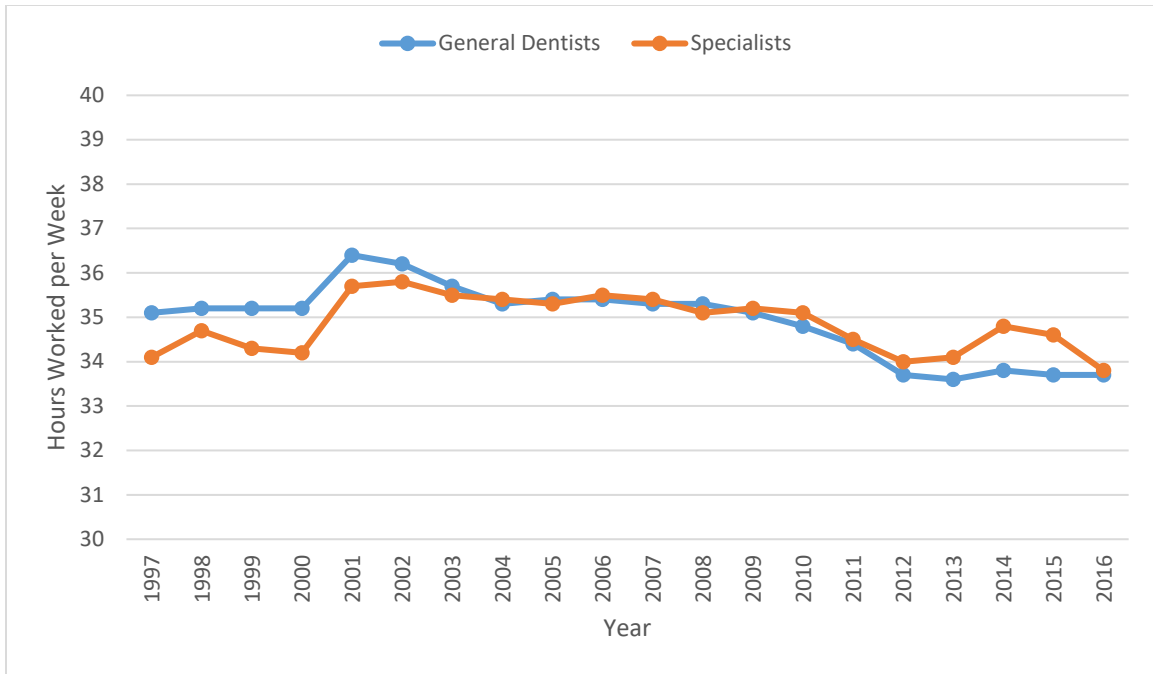


Figure 104. Hours worked per week, on average, by private practice Iowa dentists, by general dentists and specialists, 1997-2016

The number of hours worked per week by general dentists and dental specialists were nearly the same, with general dentists working slightly more hours at the beginning of the Iowa Dentist Tracking System and the reverse occurring during the later years.

The range of hours for general dentists was 33.6 hours per week (2013) to 36.4 (2001). Similarly, the range for clinical dental specialists was 33.8 hours per week (2016) to 35.8 (2002).

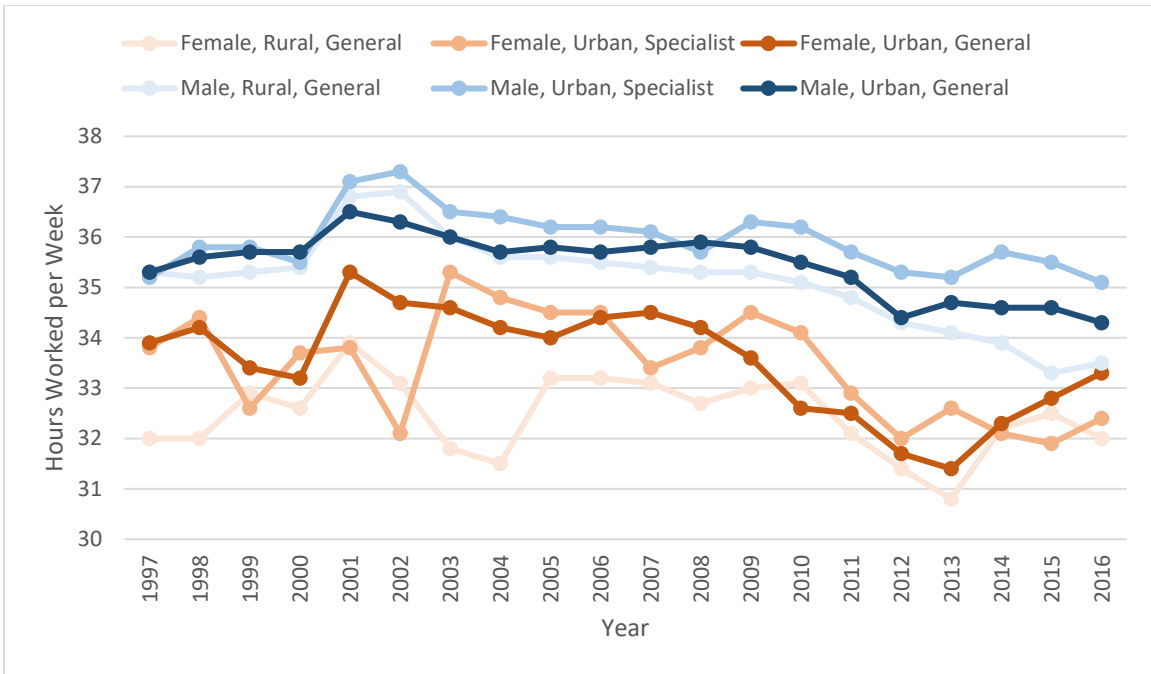


Figure 105. Hours worked per week, on average, by private practice Iowa dentists, by combination of sex, location, and specialty, 1997-2016

Among private practitioners, male dental specialists who practiced in urban areas worked the greatest number of hours per week, on average. Regardless whether they were general dentists or specialists, male dentists in either urban or rural locations worked more hours than their female counterparts. Female dentists in rural areas worked, on average, the fewest hours of any of these groups.

Since there is a paucity of dental specialists in rural areas, the graph above does not include this group.

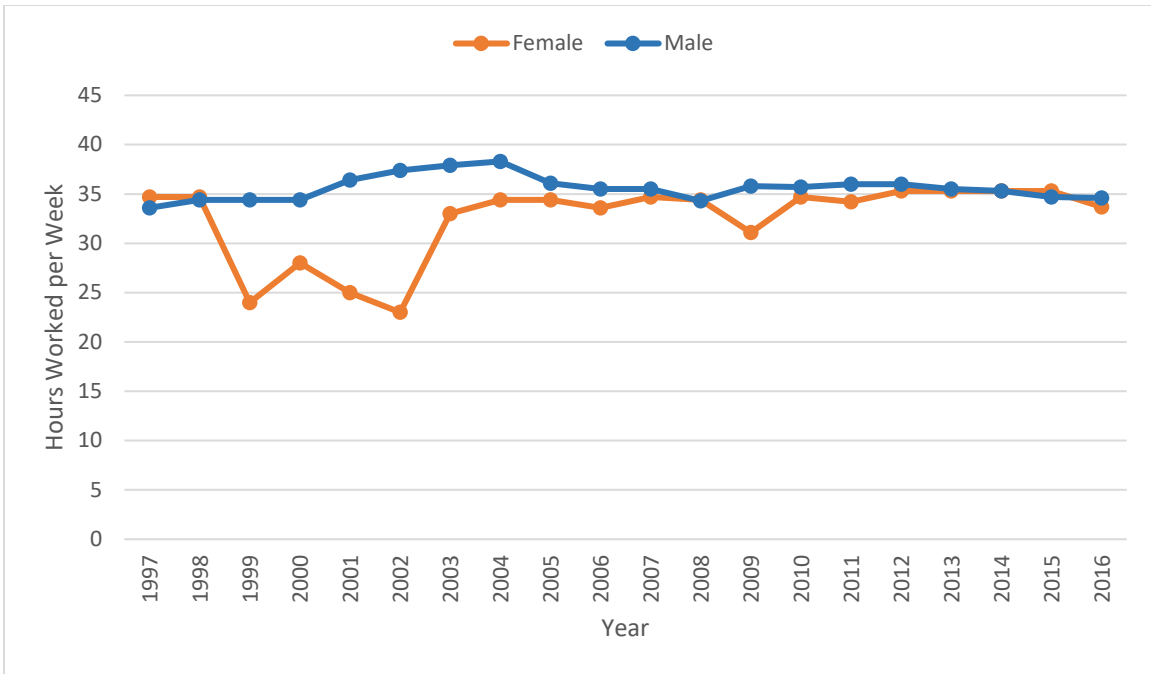


Figure 106. Hours worked per week, on average, by private practice endodontists, by sex, 1997-2016

Among private practice endodontists, males, on average, worked slightly more than females, but the difference has almost been eradicated during the past few years. The number of hours worked per week ranged from 23.0 in 2002 to 35.3 (2012 through 2015) for female endodontists and 33.6 (1997) to 38.3 (2004) for male endodontists.

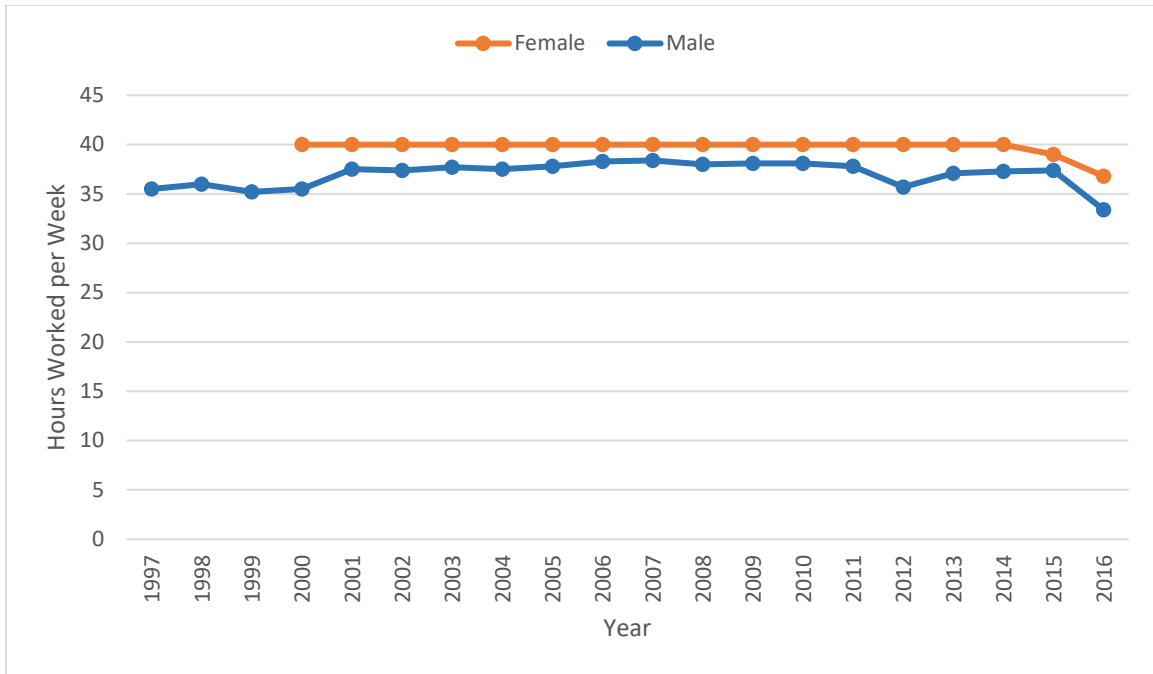


Figure 107. Hours worked per week, on average, by private practice oral and maxillofacial surgeons, by sex, 1997-2016

Male oral surgeons consistently worked in excess of 35 hours until the final year of this review. The highest number of hours worked per week was 38.4 (2007) and the lowest was 33.4 (2016).

Although the number of hours per week was higher for female oral surgeons, there are relatively few of them. The first female oral surgeon in Iowa who was in private practice appeared in 2000.

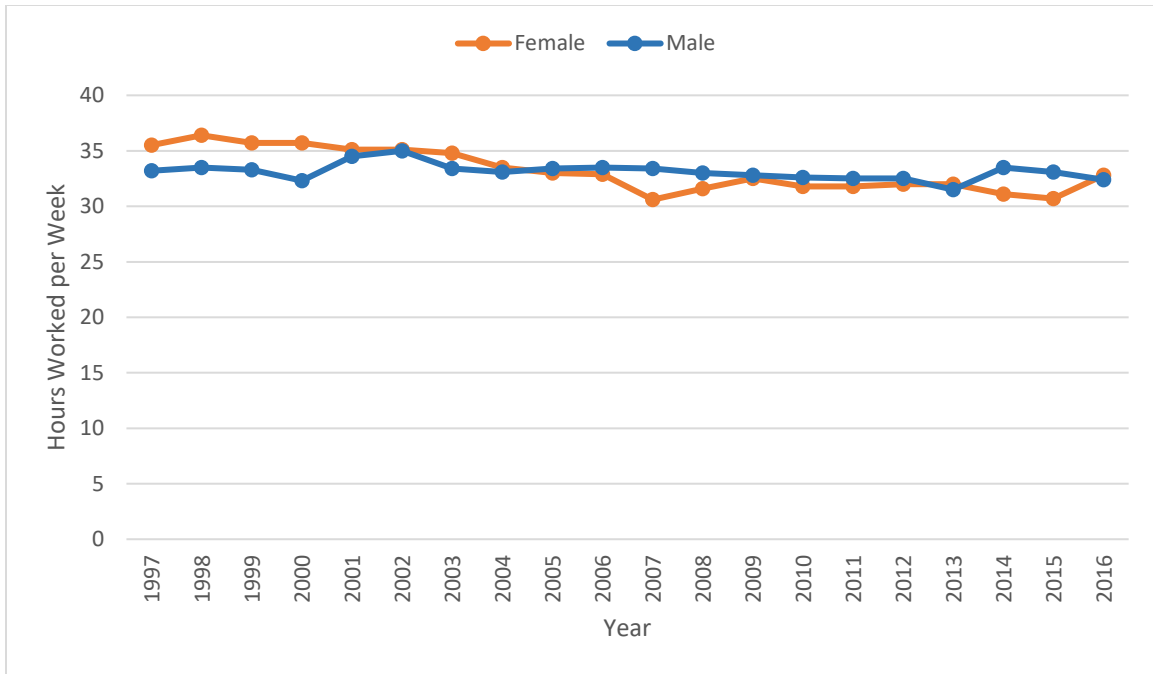


Figure 108. Hours worked per week, on average, by private practice orthodontists, by sex, 1997-2016

Initially, the average number of hours worked per week was greater for female than male orthodontists. Thereafter, males worked slightly more hours.

The number of hours worked by female orthodontists ranged from 30.7 (2015) to 36.4 (1998). For male orthodontists the number of hours worked ranged from 31.5 (2013) to 35.0 (2002).

Orthodontists worked, on average, the least number of hours per week of any of the clinical specialists in private practice.

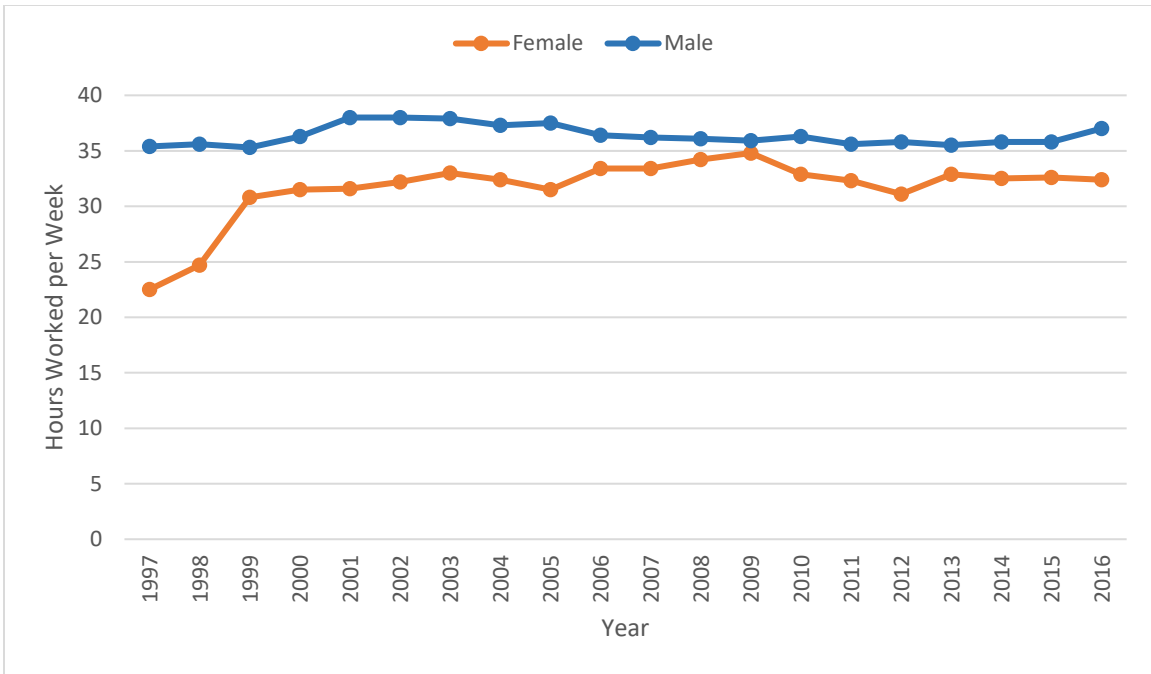


Figure 109. Hours worked per week, on average, by private practice pediatric dentists, by sex, 1997-2016

Male private practice pediatric dentists worked more hours per week, on average, than females. The range of hours for male pediatric dentists was 35.3 (1999) and 38.0 (2001 and 2002). The range of hours worked for females was 22.5 (1997) and 34.8 (2009).

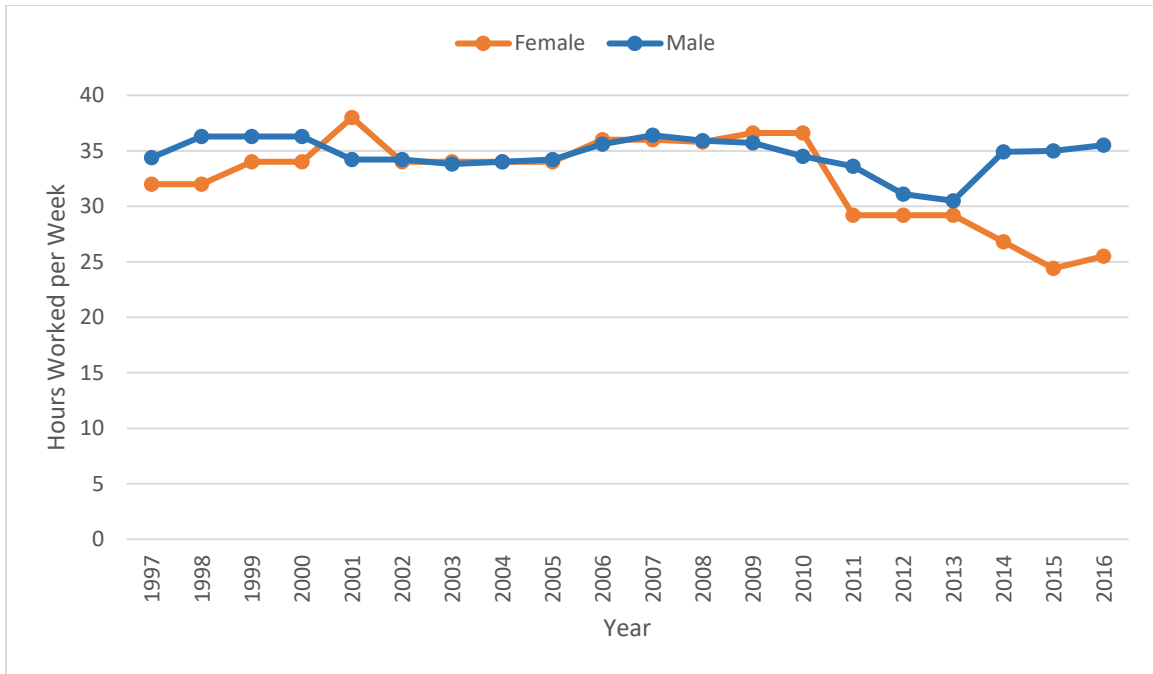


Figure 110. Hours worked per week, on average, by private practice periodontists, 1997-2016

For many years during this review male and female periodontists worked, on average, nearly identical hours per week in private practice. Since 2011, however, the number of hours has dropped off for female periodontists.

The number of hours worked per week for females ranged from 24.4 (2015) to 38.0 (2001). Among males the number of hours ranged from 30.5 (2013) to 36.4 (2007).

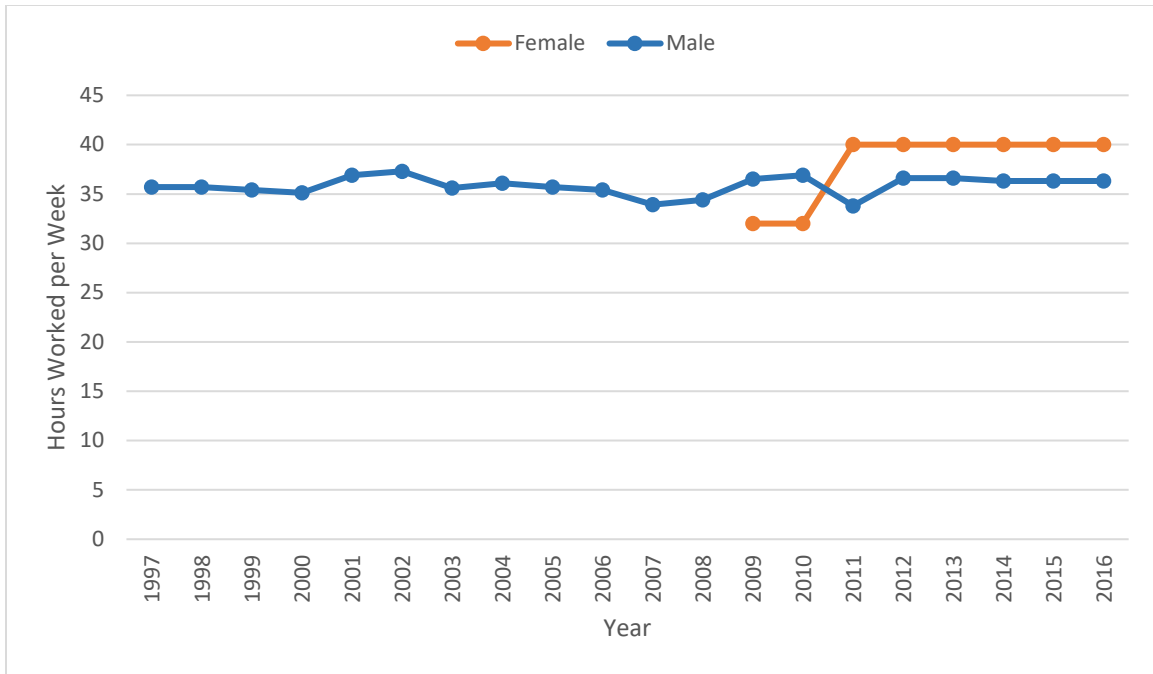


Figure 111. Hours worked per week, on average, by private practice prosthodontists, by sex, 1997-2016

There were no female private practice prosthodontists prior to 2009. From 2009 onward, the average number of hours worked per week for females ranged between 32.0 (2009 and 2010) and 40 (2011 and forward). Male prosthodontics worked between 33.8 (2011) and 37.3 (2002) hours per week.

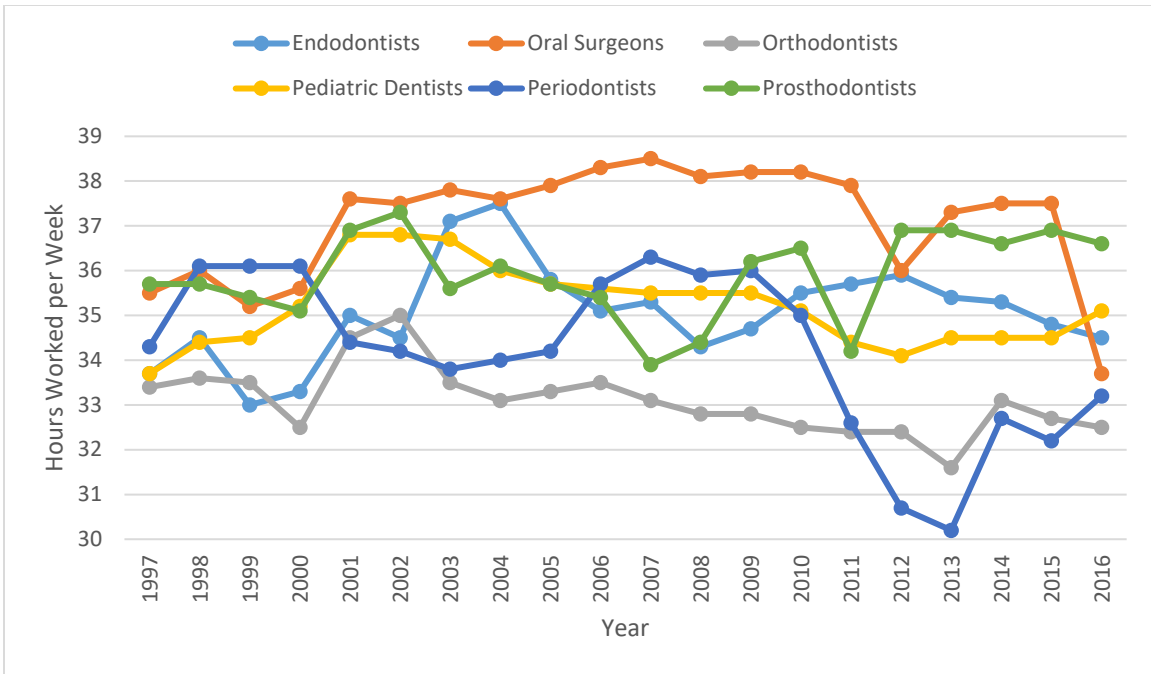
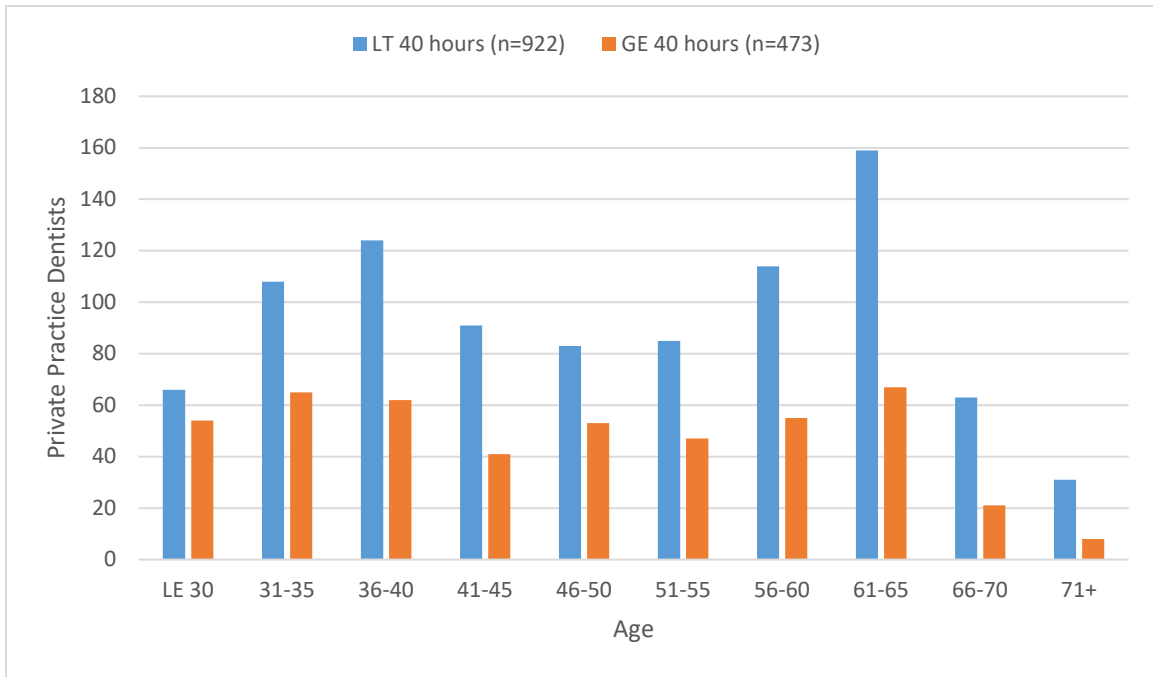


Figure 112. Hours worked per week, on average, by all private practice dental specialists, 1997-2016

Oral and maxillofacial surgeons worked more hours per week, on average, than any of the other clinical specialties in private practice. At the other end of the spectrum, orthodontists consistently worked the fewest hours per week.

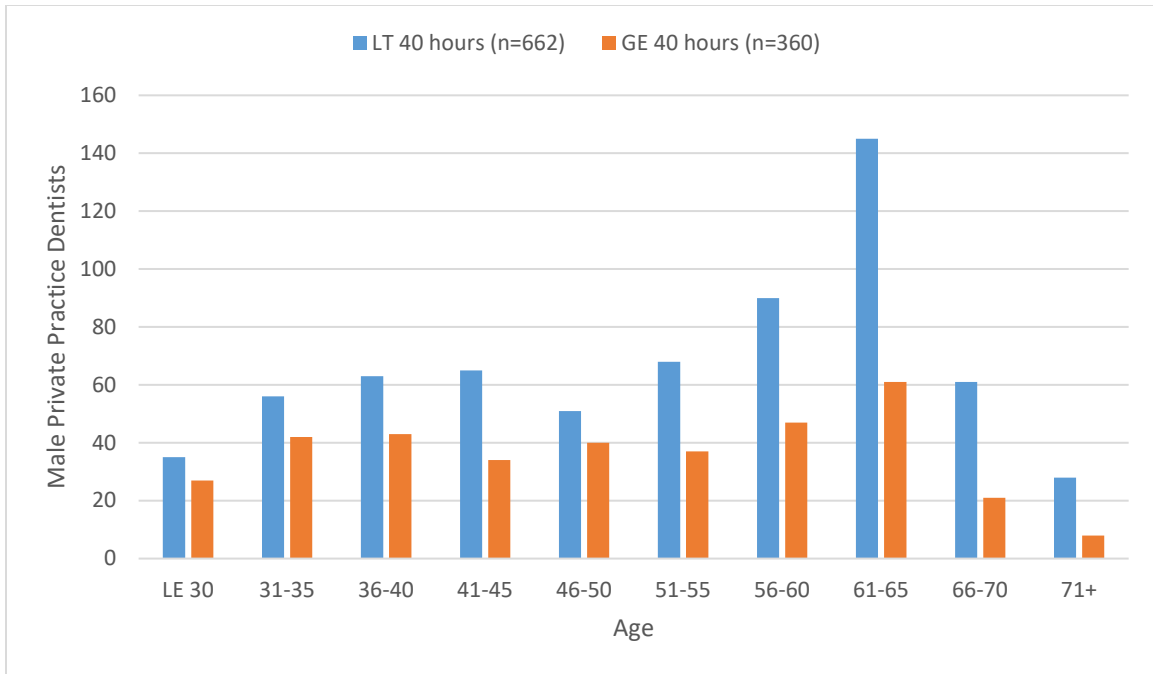


LT = less than; LE = less than or equal to; GE = greater than or equal to

Figure 113. Age of private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=1,395)

In 2016, 34% of all private practice Iowa dentists worked 40 or more hours per week. The mean age for those who worked 40 or more hours per week was 47.0, whereas the mean age for those working less than 40 hours per week was 49.5 years of age.

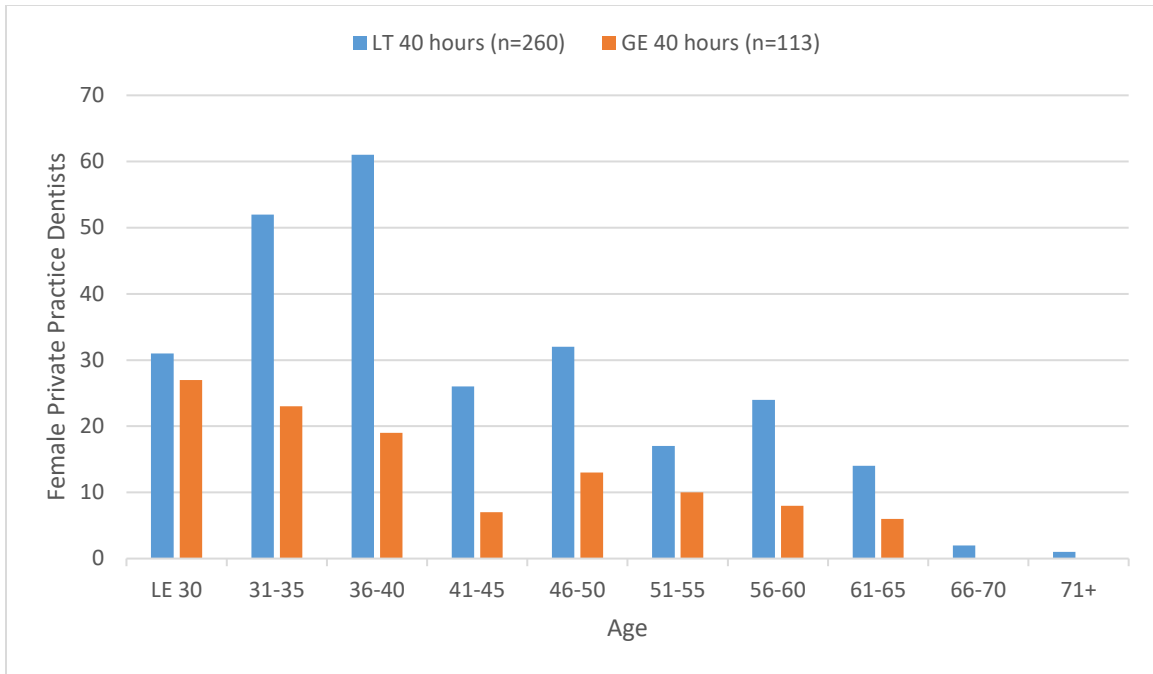
Those aged 30 years or less had the highest percent (45%) working 40 or more hours. Thereafter, the percent drops until the 46-50 age group, where 39% worked 40 or more hours. Beyond age 50, the rate for each group declines.



LT = less than; LE = less than or equal to; GE = greater than or equal to

Figure 1144. Age of male private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=1,022)

In 2016, 35% of male private practice dentists worked 40 or more hours per week in 2016. Among this group the mean age was 49.2 years. By comparison, the mean age for male private practice dentists who worked less than 40 hours per week was 52.4 years. Male private practice dentists 50 years of age or less, with the exception of the 41-45 age group, included more than 40% who worked 40 or more hours per week. After age 50, the percent declines for each age group, reaching a low of 22% for those greater than 70 years of age.



LT = less than; LE = less than or equal to; GE = greater than or equal to

Figure 1155. Age of female private practice Iowa dentists who work, on average, less than 40 hours per week versus those working 40 or more hours, 2016 (N=373)

Thirty percent of female private practice dentists worked 40 or more hours per week in 2016. The mean age for this group of women was 40.2 years of age. By comparison, the mean age for female dentists who worked less than 40 hours per week was 42.0 years. Forty-seven percent of those 30 years of age and younger worked 40 or more hours per week. Thereafter, the percent working 40 or more hours per week declined until ages 51-55, where it increased to 37%.

Full-Time Versus Part-Time

The Iowa Dentist Tracking System has consistently defined full-time work as 32 or more hours per week. Part-time is less than 32 hours per week.

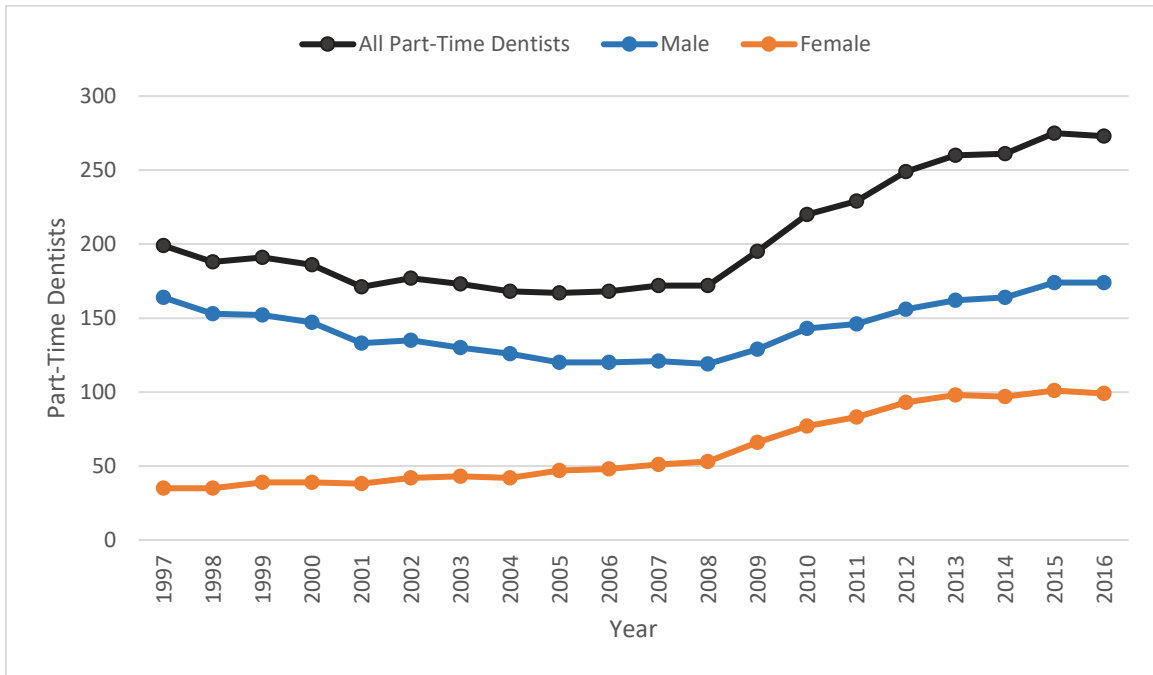


Figure 1166. Number of part-time active Iowa dentists, by sex, 1997-2016

The number of active Iowa dentists who worked part-time ranged from 167 (2005) to 275 (2015). For female dentists the number who worked part-time ranged from 35 (1997 and 1998) to 101 (2015). Among males the number who worked part-time ranged from 119 (2008) to 174 (2015).

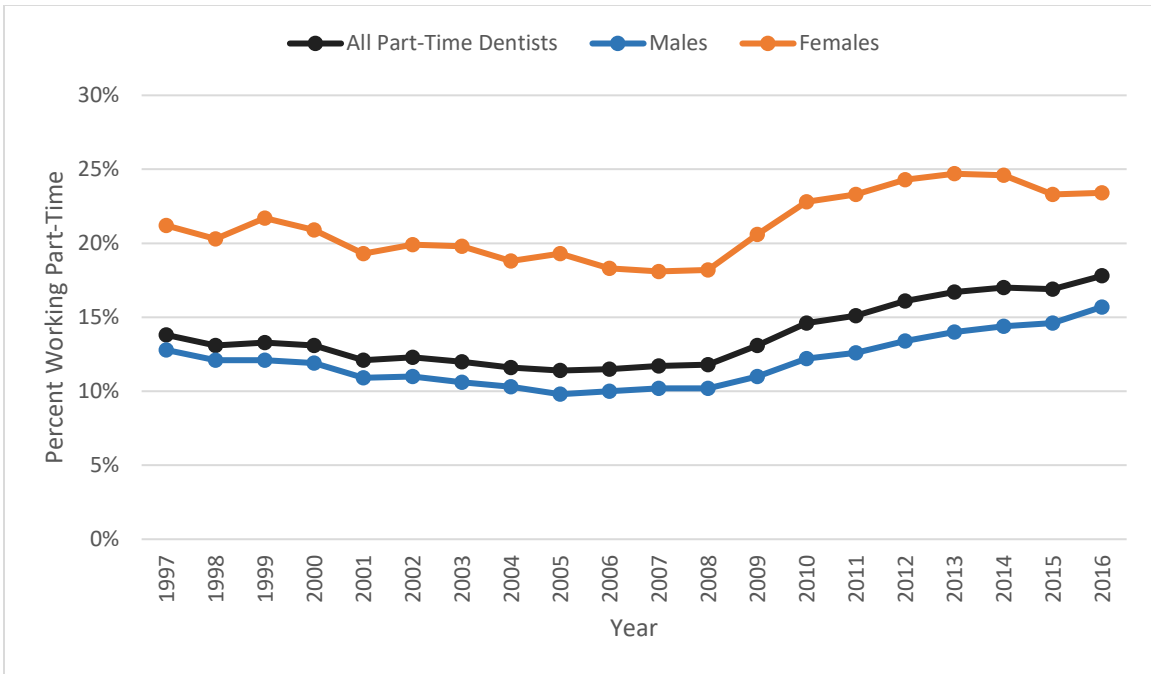


Figure 1177. Percent of active Iowa dentists who work part-time, by sex, 1997-2016

The percent of all active Iowa dentists who worked part-time ranged from 11.5% (2005) to 17.8% (2016). The percent of female dentists who work part-time exceeded their male counterparts for each of the 20 years. The percent of females who worked part-time ranged from 18.1% (2007) to 24.7% (2013), whereas, the percent of males who worked part-time ranged from 9.8% (2005) to 15.7% (2016).

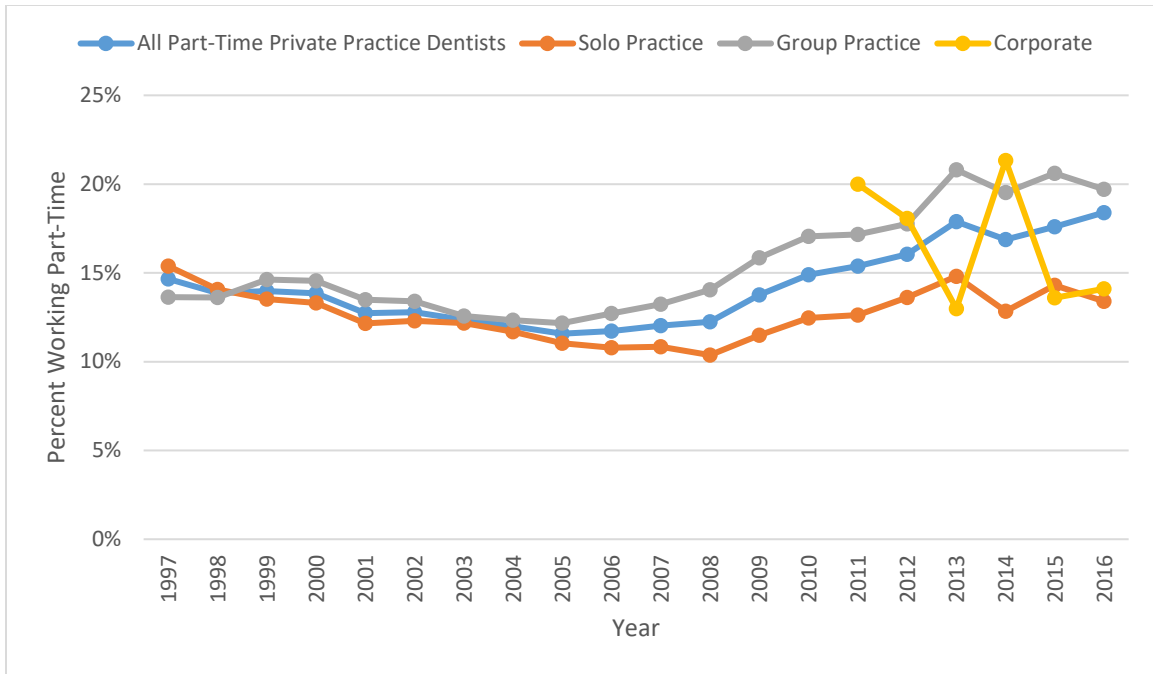


Figure 1188. Percent of private practice Iowa dentists working part-time, by practice arrangement, 1997-2016

Among all practice types, the percent who worked part-time ranged from a low of 12% (2005) to a high of 18% (2016).

Those in group practice tended to have a higher percentage who worked part-time versus those in solo practice, especially after 2005. The percent of group practice dentists who worked part-time ranged from 12% (2005) to 21% (2013 and 2015) and the percent of solo practitioners who worked part-time ranged from 10% (2008) to 15% (2013). The percent for corporate practice is somewhat erratic due to the relatively lower number of practitioners in that category.

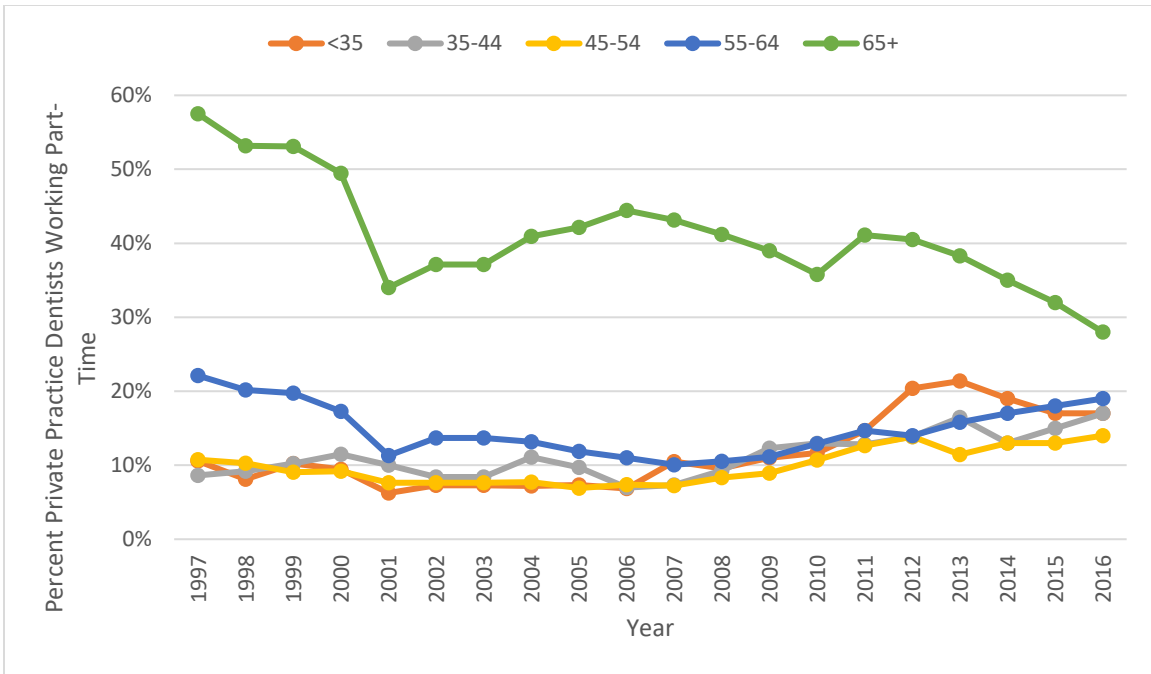


Figure 11919. Percent of private practice Iowa dentists working part-time, by age group, 1997-2016

Those dentists who were 65 years of age and older consistently had the highest percent who worked part-time, ranging from 28% (2016) to 58% (1997). Please note that for this time period almost all dentists in the 65 and older age group were male.

During the period from 2006 to 2016 there was an uptick in the percent of dentists less than 65 years of age who worked part-time; however, the greatest increase was among those less than 35 years of age.

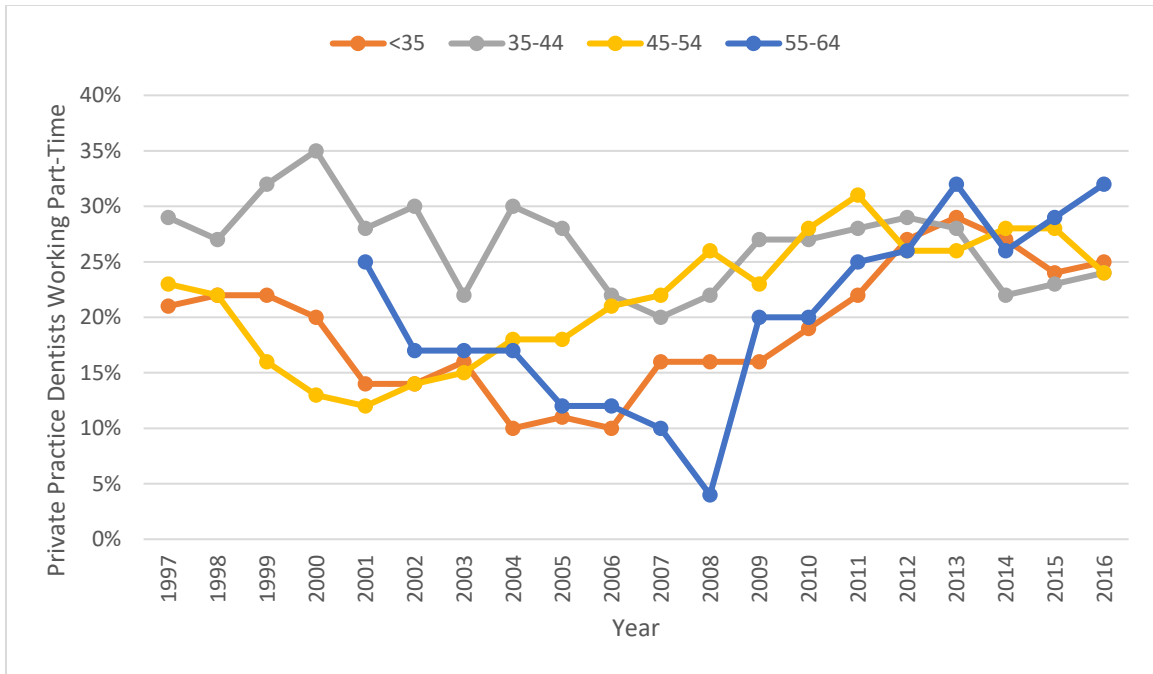


Figure 1200. Female private practice dentists who work part-time, by age category, 1997-2016

For the age groups less than 35 years of age and those 45 through 54, there was an initial decline in the percent of female private practice dentists who worked part-time, followed by an increase in the mid-2000s. For those 55 years and older, a downturn occurred from 2001 through 2008, followed by a rapid rise in the percent who worked part-time.

Prior to 2001 there were no Iowa female dentists older than 54 years of age. We do not display the 65 year and older category because it contained less than 10 female dentists over this time period.

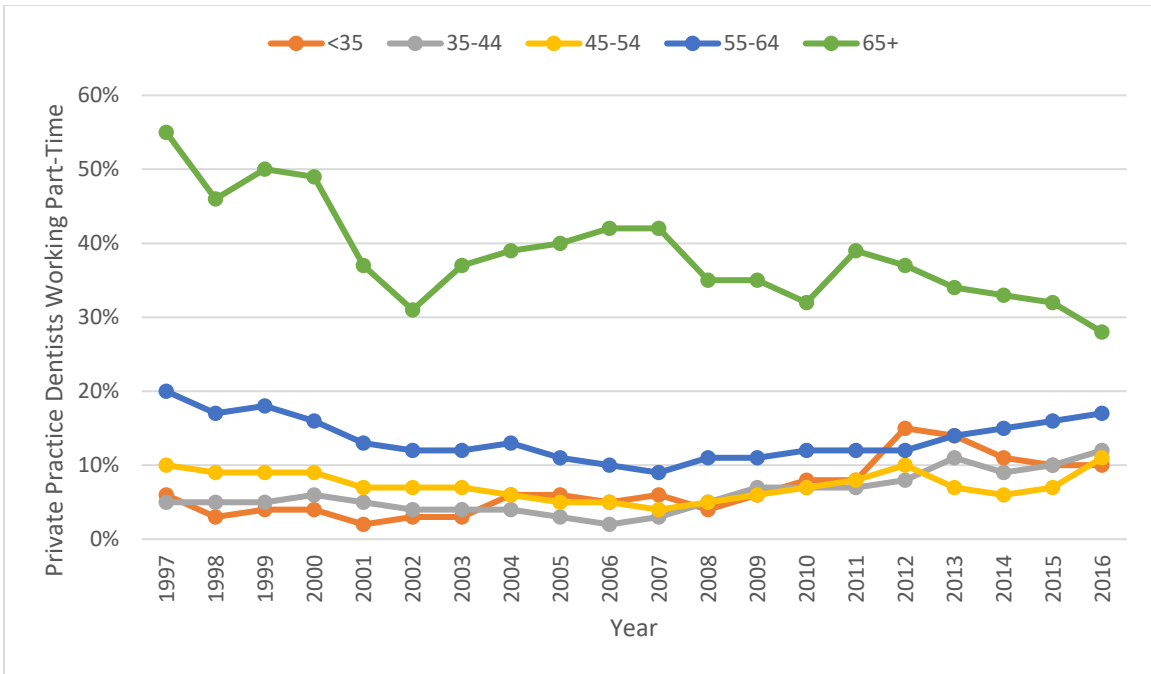


Figure 1211. Male private practice dentists who work part-time, by age category, 1997-2016

The percent of private practice dentists 65 years of age and older who work part-time has trended downward during these 20 years, from a high of 55% in 1997 to a low of 28% in 2016. The percent of private practice dentists who worked part-time increased for both age groups less than 45 years of age.

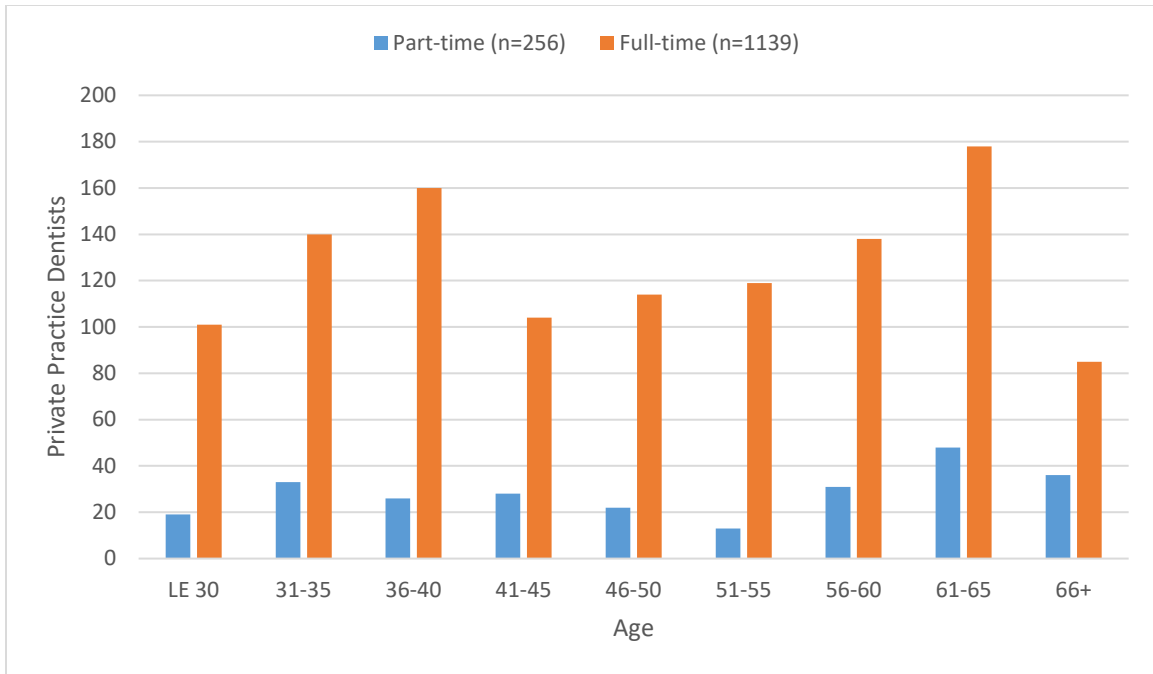


Figure 1222. Age of private practice Iowa dentists, by full- versus part-time status, 2016 (N=1395)

In 2016, 42% of dentists over age 65 worked part-time. The age group with the lowest percent who worked part-time (7.1%) was between 51 and 55 years.

Mean age for those who worked full-time was 48.2. The mean age for those who worked part-time was 50.6 years.

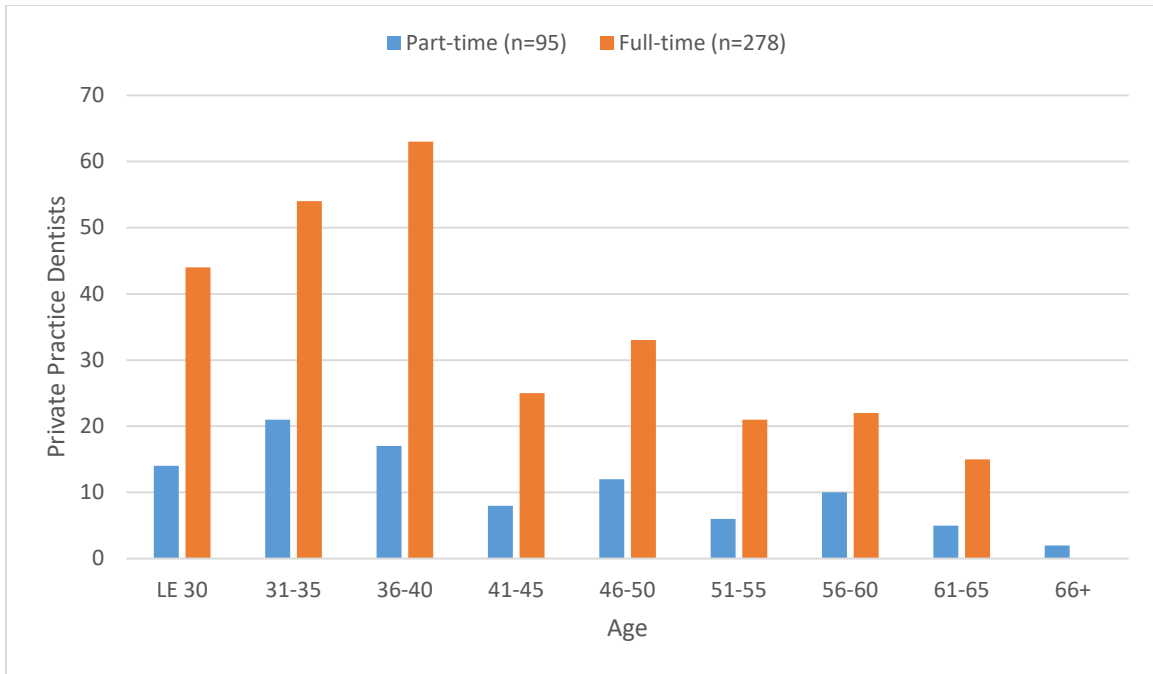


Figure 1233. Age of female private practice Iowa dentists, by full- versus part-time status, 2016 (N=373)

In 2016, at least 25% of each age group of female private practice dentists worked part-time. The lowest part-time percentage was 27% for the age group 36-40 years and the highest (besides the 66+ age group) was for those 55-60 years at 45.5%.

The mean and median ages for female dentists who worked full-time were 41.4 and 42 years, respectively. Among part-time female dentists the mean and median ages were 39 and 40 years, respectively.

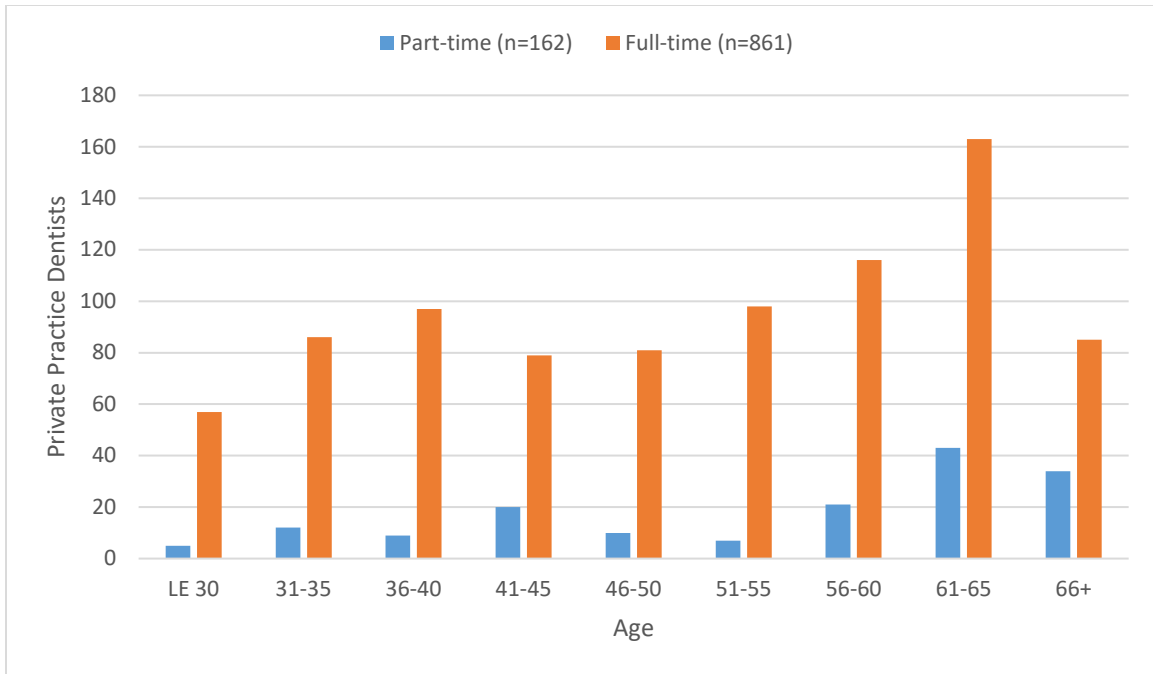


Figure 1244. Age of male private practice Iowa dentists, by full- versus part-time status, 2016 (N=1,023)

In 2016, the age group with the lowest percentage of part-time male dentists was 51-55 years (7.1%). Conversely, the highest percentage (40.0%) was for those 66 years and older. Interestingly, one-quarter of the 41- to 45-year-old age group worked part-time.

The mean and median ages for male dentists who worked full-time were 50.4 and 52 years, respectively. Among part-time male dentists the mean and median ages were 55.1 and 59 years, respectively.

Population-to-Dentist Ratios

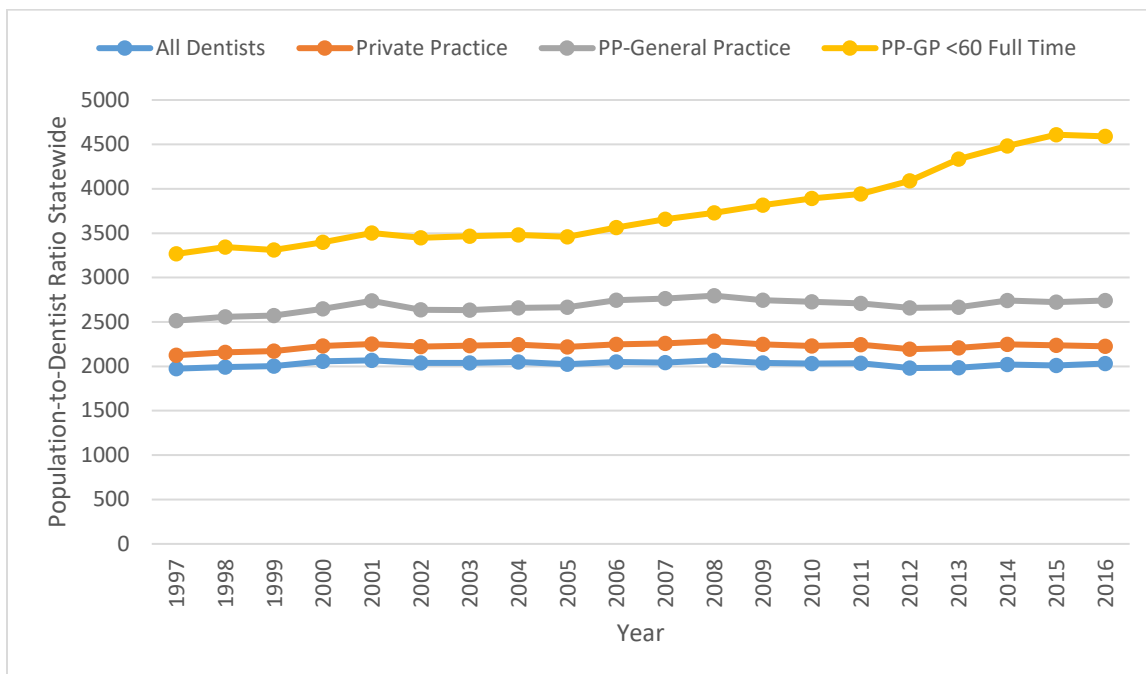


Figure 1255. Population-to-dentist ratios across dentist categories

The population-to-dentist ratio is found using the estimated total population for Iowa (based on US Census Bureau for the respective year), which is divided by the total number of dentists in the state. The ratio is the resulting number to 1 dentist. Thus, a population-to-dentist ratio of 2,020:1 reflects that there is one dentist for every 2,020 individuals in the state. It does not account for the distribution of either the population or the dentists in the state, and it includes all active dentists regardless of their specialty and number of hours worked weekly.

Thus, although the population-to-total dentist ratio is 2,031:1 in 2016, that number increases with each of the following additional criteria.

Population-to-private practice dentist: 2,227:1

Population-to-private practice general dentist: 2,742:1

Population-to-private practice general dentist who is 60 years or less and who works full-time: 4,590:1

Population-to-dentist ratios can be somewhat deceiving because most people incorrectly think that all active dentists are in private practice. However, even if a dentist is in private practice, he or she may not be working either a “normal” business week or at peak efficiency. What follows is an explanation of this ratio for 2016 using various criteria.

There were 1,530 active dentists during that year, which would translate to a population-to-dentist ratio of 2,031:1 using US Census population estimates. Parenthetically, you might see this written as the number of dentists per a selected population size (e.g., 4.9 dentists per 10,000 population).

However, 135 active dentists were either in education (e.g., faculty at the University of Iowa College of Dentistry), research, or an administrative position in government or a non-profit organization. This leaves 1,395 active dentists whose primary function is to provide clinical dental services on a daily basis. Thus, the population-to-dentist ratio for all private practitioners in the state in 2016 was 2,227:1.

However, not all private practitioners were general dentists. In 2016, there were 262 private practice dental specialists who limited their practice to a specific area of expertise (e.g., orthodontics, oral and maxillo-facial surgery). Eliminating private practice dental specialists leaves 1,133 general dentists who were in private practice in Iowa. Now, the population-to-dentist ratio for general dentists in private practice was 2,742:1.

Studies indicate that dentists 60 years and older, even when they work full-time, are not as productive as their younger colleagues. Dentists also vary in the number of hours they work. Although there is no uniformly accepted definition of what constitutes “full-time”, the Iowa Dentist Tracking System defines 32 or more hours of work per week as full-time. Calculating the number of private practice general dentists who were less than 60 years of age and worked 32 hours or more per week leaves 677 Iowa dentists. In 2016, the population-to-dentist ratio for this final group was 4,590:1.

As demonstrated, the population-to-dentist ratio ranges dramatically depending on which groups of dentists are included in the calculation.

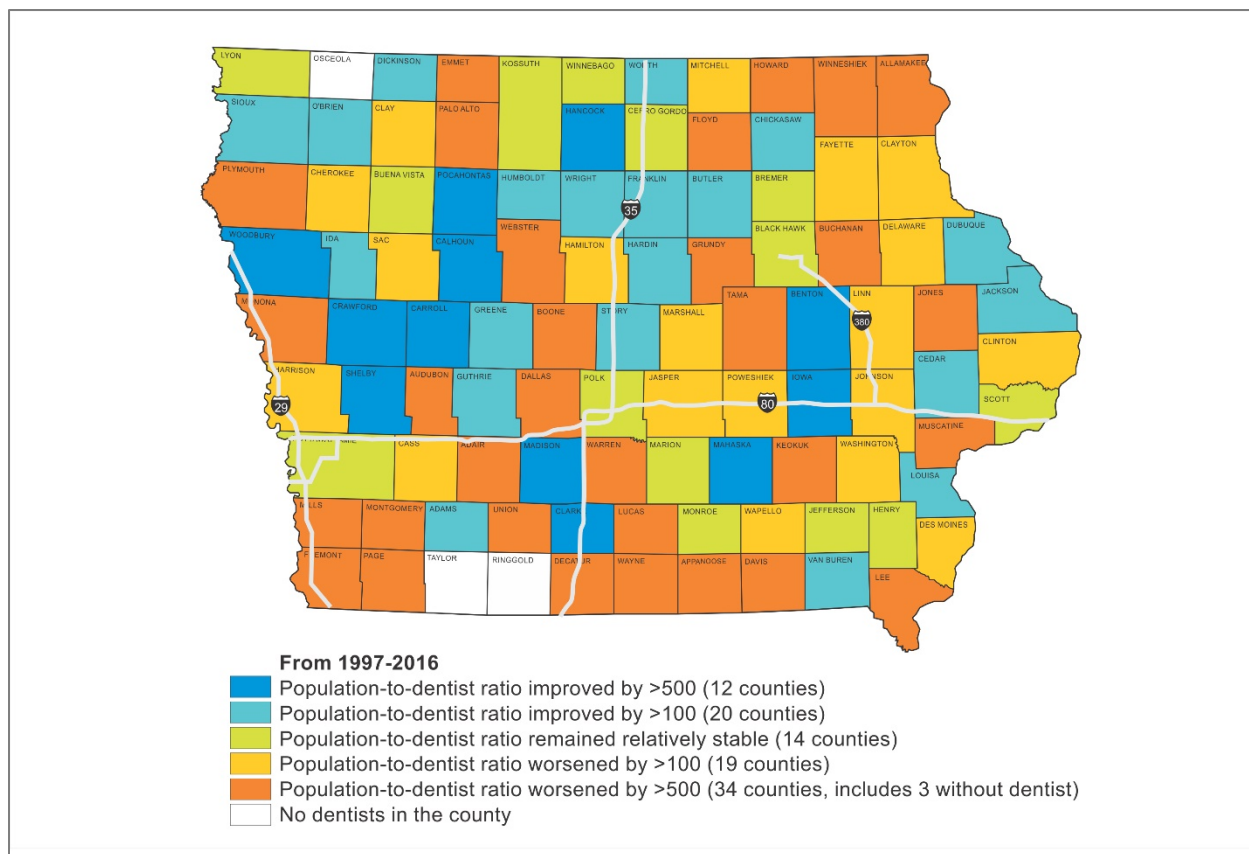


Figure 1266. Iowa population-to-dentist ratio changes, by county, 1997-2016

Although the statewide population-to-dentist ratio remained relatively stable from 1997 to 2016 (i.e., slightly greater than 2,000:1), there have been some major changes in several counties.

In 2016, only Johnson County, where the University of Iowa is located, had a population-to-dentist ratio less than 1,000:1. There were an additional 19 counties that had a range between 1,001 and 2,000:1. Conversely, 18 counties were between 3,001 and 4,000:1, 10 counties between 4,001 and 5,000:1 and 13 greater than 5,000:1, including 3 (Osceola, Ringgold, and Taylor) where there were no dentists.

Surprisingly, there were 4 counties (Benton, Butler, Van Buren, and Worth) that had greater than 4,000:1 ratio but had improved this ratio by more than 100 since 1997.

Conversely, 5 counties (Johnson, Clay, Linn, Clinton, and Page) with population-to-dentist ratios of less than 2,000:1 had a decrease of more than 100 in the ratio since 1997. Page County (in southwest Iowa) was the sole county to decline by more than 500 in its population-to-dentist ratio since 1997.

Table 7. County population-to-dentist (all active) ratios for 1997, 2006, and 2016, listed from lowest to highest for 2016

| Area | 1997 Ratio | 2006 Ratio | 2016 Ratio | Change in Population-to-Dentist Ratio |
|----------------------|--------------|--------------|--------------|---------------------------------------|
| State of Iowa | 1,974 | 2,029 | 2,031 | 57 |
| Johnson | 728 | 756 | 955 | 227 |
| Winnebago | 1,340 | 1,368 | 1,320 | -20 |
| Dubuque | 1,800 | 1,523 | 1,417 | -383 |
| Pocahontas | 2,208 | 1,910 | 1,428 | -781 |
| Polk | 1,657 | 1,705 | 1,625 | -32 |
| Clay | 1,466 | 1,394 | 1,652 | 185 |
| Cerro Gordo | 1,654 | 1,694 | 1,664 | 10 |
| Henry | 1,652 | 2,010 | 1,685 | 33 |
| Dickinson | 2,006 | 2,078 | 1,694 | -313 |
| Scott | 1,643 | 1,568 | 1,697 | 54 |
| Woodbury | 2,264 | 1,914 | 1,763 | -500 |
| Linn | 1,607 | 1,729 | 1,800 | 193 |
| Wright | 2,019 | 4,396 | 1,834 | -185 |
| Clarke | 4,115 | 4,537 | 1,843 | -2,271 |
| Clinton | 1,728 | 2,142 | 1,848 | 121 |
| Carroll | 2,403 | 2,307 | 1,869 | -533 |
| Page | 1,238 | 1,604 | 1,937 | 699 |
| Adams | 2,204 | 4,141 | 1,938 | -266 |
| Black Hawk | 2,023 | 1,947 | 1,984 | -39 |
| Shelby | 2,615 | 2,461 | 1,991 | -623 |
| Iowa | 3,864 | 3,186 | 2,047 | -1,817 |
| Buena Vista | 1,964 | 3,267 | 2,058 | 94 |
| Pottawattamie | 2,031 | 2,292 | 2,070 | 38 |
| Winneshiek | 1,488 | 1,732 | 2,077 | 589 |
| Hamilton | 2,005 | 2,622 | 2,160 | 155 |
| Jackson | 2,510 | 2,855 | 2,165 | -345 |
| Jefferson | 2,133 | 1,936 | 2,166 | 33 |
| Sioux | 2,608 | 3,568 | 2,168 | -440 |
| Kossuth | 2,238 | 1,958 | 2,175 | -64 |
| Wapello | 1,971 | 1,982 | 2,201 | 229 |
| Hancock | 3,003 | 1,914 | 2,205 | -797 |
| Marion | 2,222 | 2,189 | 2,224 | 2 |
| Des Moines | 2,005 | 1,926 | 2,236 | 232 |
| Story | 2,497 | 2,385 | 2,240 | -258 |

| Area | 1997 Ratio | 2006 Ratio | 2016 Ratio | Change in Population-to-Dentist Ratio |
|-------------|-------------------|-------------------|-------------------|--|
| Bremer | 2,330 | 2,615 | 2,247 | -83 |
| Cedar | 2,570 | 2,571 | 2,301 | -269 |
| Webster | 1,488 | 1,752 | 2,310 | 822 |
| Poweshiek | 2,104 | 2,068 | 2,334 | 230 |
| O'Brien | 2,497 | 2,838 | 2,343 | -154 |
| Harrison | 2,184 | 3,108 | 2,387 | 203 |
| Marshall | 1,939 | 2,592 | 2,404 | 465 |
| Humboldt | 2,591 | 2,441 | 2,410 | -181 |
| Crawford | 3,293 | 4,122 | 2,461 | -832 |
| Hardin | 2,642 | 2,205 | 2,473 | -169 |
| Franklin | 2,727 | 2,644 | 2,609 | -118 |
| Floyd | 2,062 | 2,334 | 2,680 | 618 |
| Cass | 2,458 | 1,987 | 2,690 | 232 |
| Mitchell | 2,216 | 2,161 | 2,695 | 479 |
| Washington | 2,611 | 2,638 | 2,759 | 148 |
| Jasper | 2,556 | 2,449 | 2,836 | 281 |
| Delaware | 2,635 | 2,927 | 2,900 | 265 |
| Fayette | 2,739 | 2,588 | 2,906 | 168 |
| Lyon | 2,992 | 2,833 | 2,921 | -71 |
| Jones | 2,261 | 2,258 | 2,922 | 661 |
| Clayton | 2,685 | 2,963 | 2,949 | 264 |
| Cherokee | 2,673 | 3,930 | 2,959 | 286 |
| Mills | 2,390 | 2,523 | 2,966 | 576 |
| Monona | 2,028 | 3,074 | 2,999 | 971 |
| Chickasaw | 3,357 | 3,067 | 3,066 | -291 |
| Greene | 3,361 | 3,189 | 3,067 | -294 |
| Plymouth | 2,469 | 2,446 | 3,109 | 640 |
| Madison | 4,580 | 5,065 | 3,122 | -1,458 |
| Union | 2,500 | 2,998 | 3,129 | 629 |
| Lee | 2,417 | 2,400 | 3,208 | 791 |
| Calhoun | 3,829 | 3,367 | 3,289 | -541 |
| Muscatine | 2,406 | 3,016 | 3,300 | 894 |
| Emmet | 2,740 | 2,593 | 3,330 | 590 |
| Sac | 2,979 | 3,491 | 3,345 | 366 |
| Warren | 2,842 | 3,120 | 3,425 | 584 |
| Montgomery | 2,370 | 2,784 | 3,474 | 1,104 |
| Allamakee | 2,001 | 2,888 | 3,510 | 1,509 |
| Ida | 4,008 | 1,755 | 3,521 | -487 |
| Guthrie | 3,825 | 5,547 | 3,574 | -251 |

| Area | 1997 Ratio | 2006 Ratio | 2016 Ratio | Change in Population-to-Dentist Ratio |
|-------------|-------------------|-------------------|-------------------|--|
| Louisa | 3,965 | 3,934 | 3,720 | -244 |
| Mahaska | 4,362 | 3,673 | 3,728 | -634 |
| Dallas | 3,253 | 4,963 | 3,870 | 617 |
| Monroe | 4,041 | 3,822 | 4,001 | -41 |
| Decatur | 2,717 | 4,186 | 4,132 | 1,415 |
| Buchanan | 3,527 | 7,653 | 4,208 | 681 |
| Appanoose | 3,377 | 3,290 | 4,220 | 843 |
| Benton | 4,997 | 5,314 | 4,280 | -717 |
| Lucas | 3,037 | 4,745 | 4,351 | 1,314 |
| Tama | 3,536 | 3,560 | 4,363 | 827 |
| Davis | 2,820 | 8,530 | 4,391 | 1,571 |
| Boone | 3,272 | 3,749 | 4,406 | 1,133 |
| Howard | 2,424 | 9,510 | 4,725 | 2,301 |
| Keokuk | 3,832 | 5,364 | 5,116 | 1,284 |
| Audubon | 2,276 | 6,179 | 5,794 | 3,518 |
| Grundy | 4,099 | 4,076 | 6,188 | 2,089 |
| Wayne | 3,388 | No Dentist | 6,395 | 3,008 |
| Fremont | 3,903 | 7,549 | 7,022 | 3,119 |
| Adair | 4,073 | 3,839 | 7,454 | 3,381 |
| Van Buren | 7,824 | 7,640 | 7,468 | -356 |
| Butler | 7,862 | 7,316 | 7,503 | -359 |
| Worth | 7,772 | 3,809 | 7,624 | -148 |
| Palo Alto | 3,360 | No Dentist | 9,099 | 5,739 |
| Taylor | 3,561 | 2,180 | No Dentist | Indeterminable |
| Osceola | 3,526 | 3,286 | No Dentist | Indeterminable |
| Ringgold | 5,366 | 5,101 | No Dentist | Indeterminable |

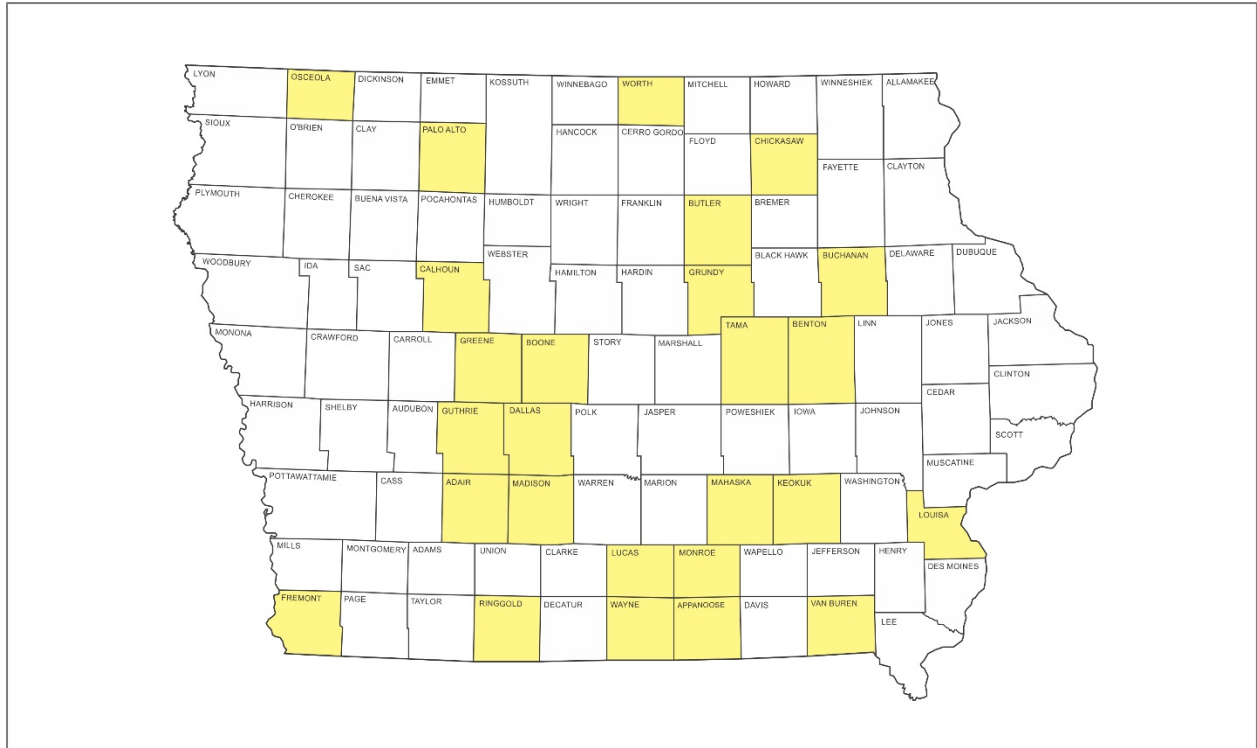


Figure 1277. Counties where the population-to-dentist ratio was greater than 3,000:1 in 1997, 2006, and 2016

Twenty-six counties had a greater than 3,000:1 ratio for each of the sentinel years. Although Dallas County is among this group, it is anticipated that recent economic development, along with its proximity to Polk County, should attract more dentists to this area in the future.

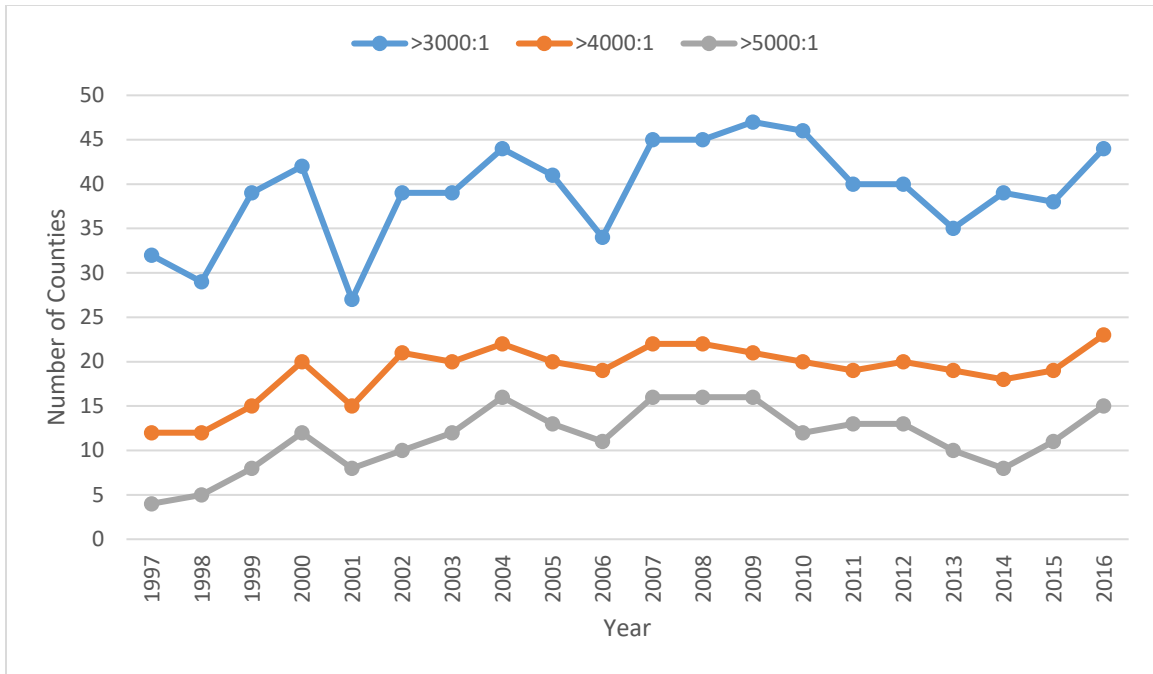


Figure 1288. Number of Iowa counties with greater than 3,000:1 population-to-dentist ratios, 1997-2016 (99 Iowa counties)

This figure presents the number of Iowa counties that have greater than 3,000, 4,000, and 5,000:1 population-to-dentist ratios. The number of counties with a population-to-dentist ratio greater than 3,000:1 ranged from a low of 27 (2001) to a high of 47 (2009). Similarly, the number of counties with a greater than 4,000:1 population-to-dentist ratio ranged from a low of 12 (1997 and 1998) to a high of 23 (2016). Lastly, the number of counties with greater than 5,000:1 population-to-dentist ratio ranged from a low of 4 (1997) to a high of 16 (2004, 2007, 2008, and 2009).

The number of counties with a greater than 3,000:1 population-to-dentist ratio includes both larger categories (i.e., 4,000:1 and 5,000:1). Likewise, the line representing the number of counties with a greater than 4,000:1 population-to-dentist ratio also includes those counties that had a population-to-dentist ratio of greater than 5,000:1.

Dental Health Professional Shortage Areas

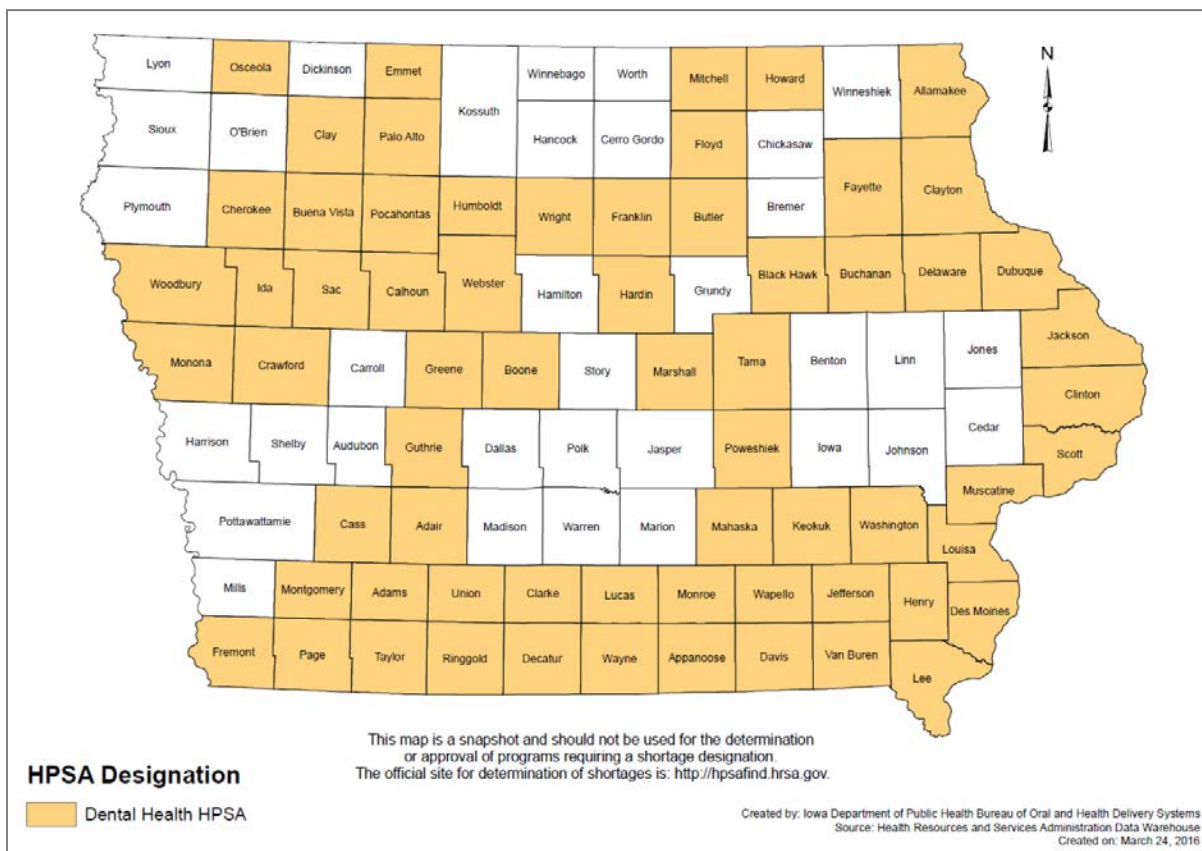


Figure 12929. Iowa Dental Health Professional Shortage Areas, 2016

During the past 20 years there have been major shifts in the number of Iowa counties that qualify as Dental Health Professional Shortage Areas (HPSAs). Please note that the map above is not intended for use as a static feature. As demonstrated in Tables 8 through 10, HPSA designations change.

For IDTS year 1997, 2006, and 2016, 26 Iowa counties had greater than 3,000:1 population-to-dentist ratios. They are: Adair, Appanoose, Benton, Boone, Buchanan, Butler, Calhoun, Chickasaw, Dallas, Fremont, Greene, Grundy, Guthrie, Keokuk, Louisa, Lucas, Madison, Mahaska, Monroe, Osceola, Palo Alto, Ringgold, Tama, Van Buren, Wayne, and Worth. With the exception of Boone (0.7% gain), Buchanan (1.2%), Dallas (31.9%), Madison (2.1%), and Wayne (2.7%) Counties, each of the aforementioned counties lost population since 2000.

Counties with a greater than 5,000:1 population-to-dentist ratio qualify for federal Dental Health Professional Shortage Area designation based on geographic area criterion. There also are designations for counties where there are insufficient dentists to treat lower-income families and Medicaid enrollees.

Each qualifying Dental HPSA area also receives a score (up to 26 points) that takes into account a combination of population-to-dentist ratio (10 points maximum), percent of the population below 100% of the federal poverty level (10 points maximum), water fluoridation status (1 point maximum), and travel time to the nearest source of care (5 points maximum). The higher the score, the greater the need for dentist services. Following is a table that lists the Iowa counties that have been designated as Dental HPSAs, along with information about their original designation year and HPSA score as of fall 2017.

Table 8. Iowa's Dental HPSA counties, fall 2017

| County | Designation type | Original Designation Year | HPSA score |
|-------------|-------------------|---------------------------|------------|
| Adams | Low income | 2001 | 7 |
| Allamakee | Low income | 2001 | 11 |
| Appanoose | Low income | 2001 | 14 |
| Boone | Low income | 2001 | 10 |
| Buchanan | Medicaid-eligible | 2001 | 11 |
| Buena Vista | Low income | 2001 | 14 |
| Calhoun | Low income | 2001 | 13 |
| Cass | Low income | 2001 | 11 |
| Clarke | Low income | 2017* | 17 |
| Clay | Medicaid-eligible | 2001 | 6 |
| Clayton | Low income | 2001 | 14 |
| Crawford | Low income | 2001 | 13 |
| Davis | Low income | 2001 | 19 |
| Decatur | Geographic | 2010 | 17 |
| Des Moines | Low income | 2001 | 16 |
| Emmet | Low income | 2001 | 10 |
| Fayette | Low income | 2001 | 5 |
| Floyd | Low income | 2006 | 10 |
| Franklin | Low income | 2001 | 12 |
| Freemont | Medicaid-eligible | 2006 | 16 |
| Greene | Low income | 2001 | 11 |
| Guthrie | Low income | 2017* | 15 |
| Howard | Low income | 2010 | 11 |
| Ida | Low income | 2001 | 11 |
| Jackson | Low income | 2001 | 10 |
| Jefferson | Low income | 2001 | 15 |
| Keokuk | Geographic | 2006 | 7 |
| Lee | Low income | 2001 | 17 |
| Louisa | Low income | 2017* | 4 |
| Lucas | Low income | 2017* | 7 |
| Mahaska | Low income | 2001 | 11 |
| Marshall | Low income | 2009 | 12 |

| County | Designation type | Original Designation Year | HPSA score |
|---------------|-------------------------|----------------------------------|-------------------|
| Mitchell | Low income | 2006 | 12 |
| Monana | Low income | 2001 | 12 |
| Monroe | Geographic | 2013 | 7 |
| Montgomery | Low income | 2001 | 14 |
| Muscatine | Medicaid-eligible | 2009 | 9 |
| Page | Low income | 2001 | 10 |
| Palo Alto | Geographic | 2006 | 7 |
| Pocahontas | Low income | 2001 | 16 |
| Ringgold | Geographic | 2010 | 15 |
| Sac | Geographic | 2017* | 10 |
| Tama | Low income | 2001 | 12 |
| Union | Low income | 2001 | 12 |
| Van Buren | Low income | 2014 | 15 |
| Wapello | Low income | 2001 | 15 |
| Washington | Medicaid-eligible | 2001 | 15 |
| Wayne | Geographic | 1978 | 13 |
| Webster | Low income | 2001 | 13 |
| Wright | Low income | 2001 | 11 |

* County’s original HPSA designation year occurred after the 20-year period of this review (1997-2016).

As of this publication, the number of Iowa Dental HPSA counties, by designation type, include:

- Geographic--8
- Low-income population--37
- Medicaid-eligible population--5

Thirty-three counties had been designated as Dental HPSAs on or before 2001. Oftentimes, counties that consistently maintain their designations are referred to as “persistent” HPSAs.

Since Table 8 was developed from fall 2017 DHHS, HRSA, Bureau of Health Professions information, there have been changes to some county designations. For instance, Table 9 shows 9 counties that had their HPSA designations withdrawn and Table 10 displays 6 counties in which the designation status changed.

Table 9. Iowa counties that had their Dental HPSA designation withdrawn

| County | Designation type | Year Withdrawn |
|---------------|-------------------------|-----------------------|
| Adair | Geographic | 2018 |
| Butler | Low income | 2018 |
| Cherokee | Low income | 2018 |
| Delaware | Low income | 2018 |
| Dubuque | Low income | 2018 |
| Hardin | Low income | 2018 |
| Osceola | Low income | 2017 |
| Poweshiek | Medicaid-eligible | 2018 |
| Scott | Medicaid-eligible | 2018 |

Table 10. Iowa counties that had their Dental HPSA designation reclassified

| County | New Designation Category | Year reclassified | HPSA score |
|---------------|---------------------------------|--------------------------|-------------------|
| Black Hawk | Low income | 2018 | 17 |
| Clinton | Low income | 2018 | 15 |
| Henry | Low income | 2018 | 9 |
| Humboldt | Low income | 2018 | 15 |
| Taylor | Low income | 2018 | 11 |
| Woodbury | Low income | 2018 | 9 |

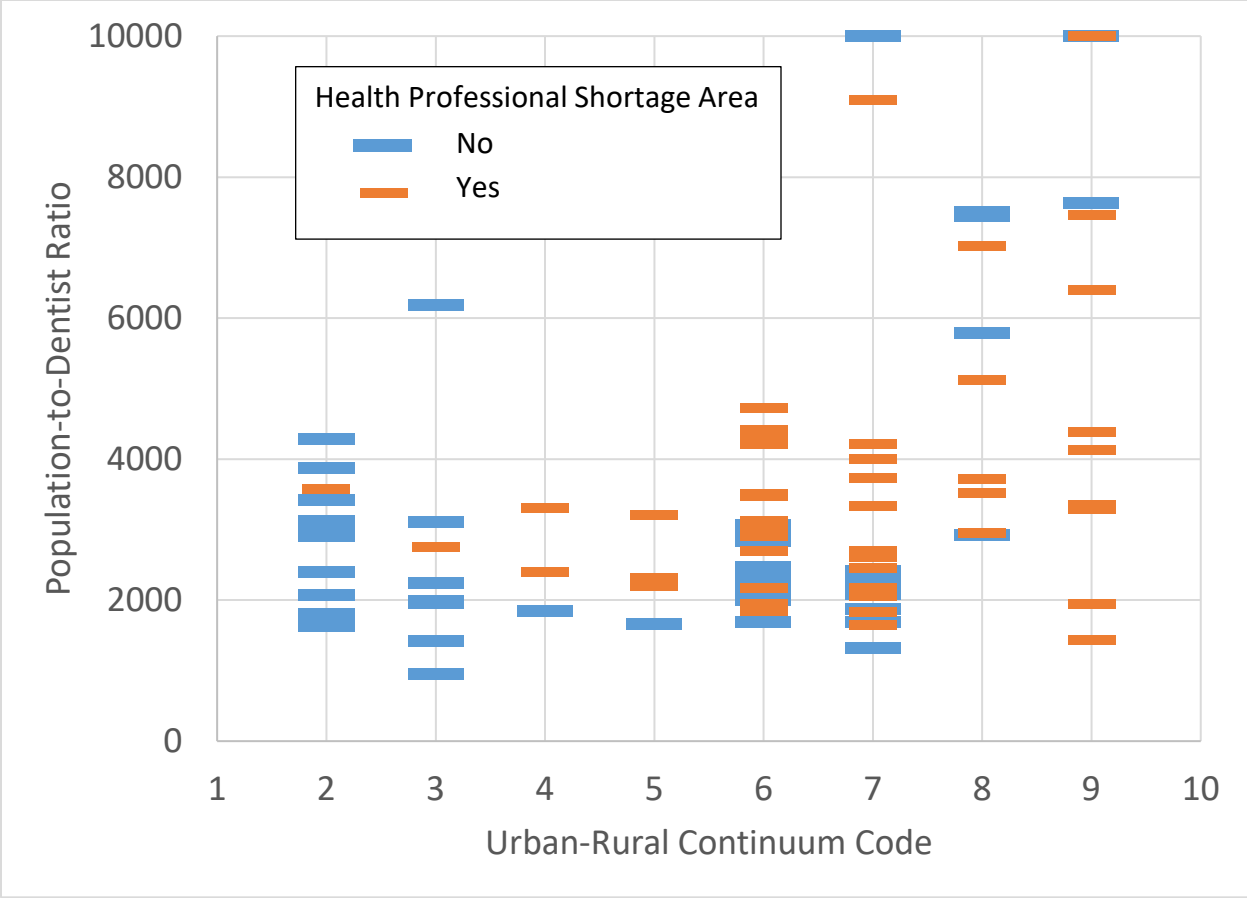


Figure 1300. Population-to-dentist ratio and Rural-Urban Continuum Code, by Dental HPSA status for each Iowa county, 2017

For this graph each county is represented as either a federally designated Dental Health Professional Shortage Area (HPSA) (orange line) or not (blue line) as of fall 2017. The population-to-dentist ratio is based on calculations from 2016. Full-time equivalents were not used in the dentist component of this ratio.

Although the frequency of dental HPSAs increases in rural areas of the state (i.e., codes 4-9) because of a greater likelihood to have a large population-to-dentist ratio, there are some urban and rural counties that have been named as shortage areas because of a paucity of dentists willing to serve some traditionally underserved populations (i.e., Medicaid enrollees, low-income). Conversely, there are several rural counties that were not Dental HPSAs yet exceed the minimum requirements for geographic designation. In part, this may be due to the county’s population in relative close proximity to a contiguous county with adequate dentists.

Three counties (Osceola, Ringgold, and Taylor) were scored as a population-to-dentist ratio of 10,000: 1 because there were no dentists.

County-Level Data

Population Change

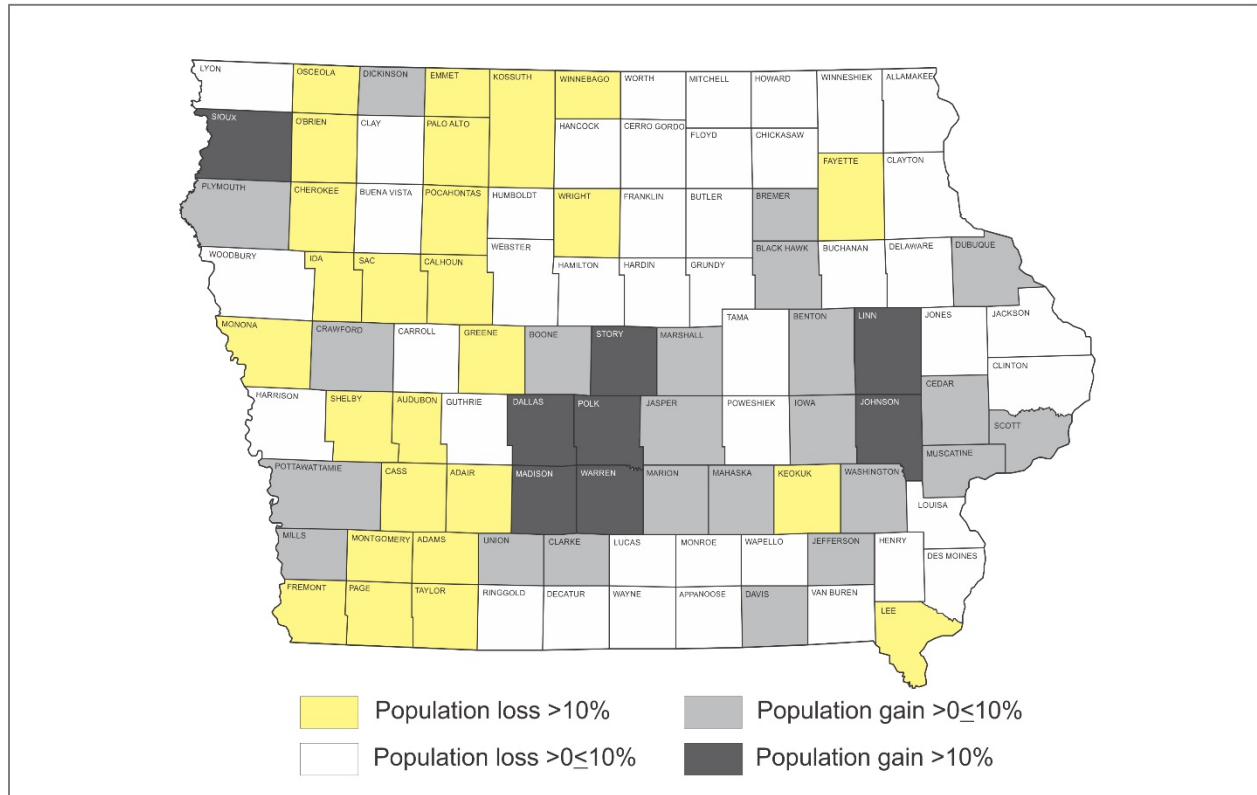


Figure 1311. Estimated population gain/loss in percentages for Iowa counties, 2000-2017

Although migration patterns have shifted throughout the 20th century, there was a profound change in 1980s Iowa with the confluence of (1) the farm crisis, which adversely impacted the economic well-being of small, farming-dependent communities, (2) metro- and micropolitan towns built several regional malls, which shifted retail opportunities away from small, isolated communities, and (3) the introduction of large discount stores (e.g., Walmart) in the state, which created severe competition with small retail stores in the same geographic region. The growth of regional economies within Iowa led to an outmigration from many rural communities.

Iowa's population growth during the past few decades has primarily been across the middle of the state. Conversely, many rural counties in the northern tier and southern two tiers have been losing population for nearly the entire century.

With the exception of Latino immigration into the state, Iowa's population growth during the past quarter century has been negligible. The Latino population now accounts for slightly more than 5% of the state's population and approximately 10% of the 18 and under population. Between 2000 and 2015, only 3 Iowa counties saw a decline in Latino population.

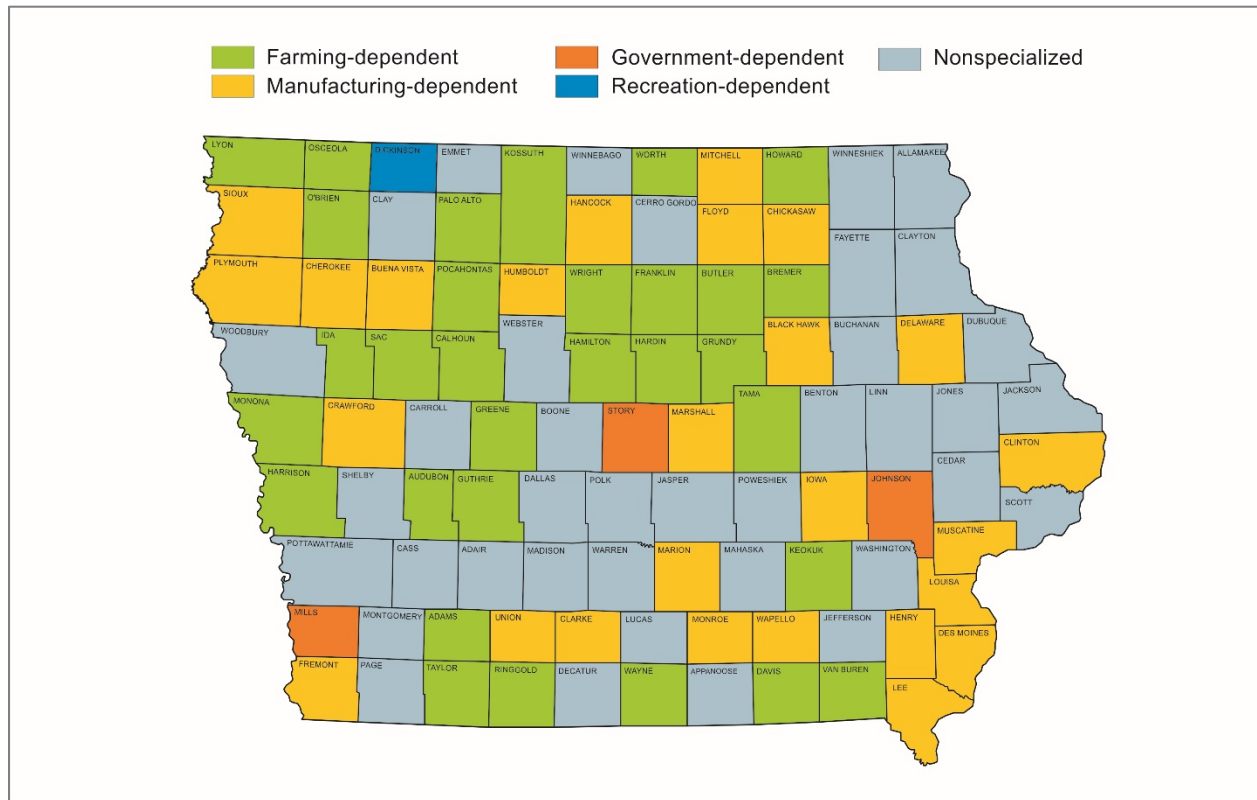
Two of the principal employment sectors of traditional rural counties have been agriculture and manufacturing. Agriculture in rural counties has seen some shifts since last decade's Great Recession. While agricultural employment in northern Iowa grew, the two southernmost tiers experienced a loss in agricultural employment.

While manufacturing employment generally declined statewide during the Great Recession, Iowa's urban areas appear to be recovering faster than their rural counterparts. The exceptions for micropolitan and metropolitan areas were in Jasper, Marion, Muscatine, and Woodbury counties. The loss of jobs in Jasper and Marion is likely associated with the closure of Maytag Industries in Newton.

Sources:

- Kusmin L. *Rural America at a Glance: 2016 Edition*. Washington, DC: Economic Research Service, US Department of Agriculture; November 2016, Economic Information No. EIB-162.
- *A Snapshot of Rural Iowa*. Ames, Iowa: Iowa State University Extension and Outreach. June 30, 2015.

County Economic Typology



Source: US Department of Agriculture, Economic Research Service

Figure 1322. Iowa county non-overlapping economic typology codes, 2015

This figure provides 2015 typological information about each county, which is based on data from the US Department of Agriculture’s Economic Research Service. The map shows the non-overlapping economic types, determined by the most prevalent job source. However, there are 7 counties that reach the threshold for inclusion in more than one category (i.e., overlapping indicators). Although farming was the most common employment source for Hamilton, Howard, and Kossuth Counties, nonetheless each county also reached the threshold for manufacturing. Conversely, in Adams, Ida, Van Buren, and Webster Counties manufacturing was the primary employment source, but each still met the threshold for farming, as well. Counties coded as “nonspecialized” did not meet minimum percentage thresholds to be earmarked for one of the other non-overlapping categories.

The US Department of Agriculture classifies all US counties “according to six mutually exclusive categories of economic dependence” including: farming, mining, manufacturing, federal/state government, recreation, and non-specialized. (<http://www.ers.usda.gov/data-products/county-typology-codes/documentation.aspx>).

- **Farming-dependent:** farming accounted for 25% or more of the county’s earnings or 16% of more of the total employment, averaged during the years 2010-2012.

- **Mining-dependent:** mining accounted for 13% or more of the county’s earning or 8% or more of the total employment, averaged during the years 2010-2012. (There are no Iowa counties that fit this category.)
- **Manufacturing-dependent:** manufacturing accounted for 23% or more of the county’s earnings or 16% or more of the total employment, averaged during the years 2010-2012.
- **Federal/state government-dependent:** federal or state government accounted for 14% or more of the county’s earnings or 9% or more of the employment, averaged during the years 2010-2012.
- **Recreation-dependent:** a combination of employment, earnings and seasonal housing were converted to z-scores. An index score of 0.67 or higher was necessary to be included as a recreation-dependent county.
- **Non-specialized:** the county did not qualify as dependent on any of the farming, mining, manufacturing, government, or recreation categories.

Table 11. National versus Iowa typology⁸

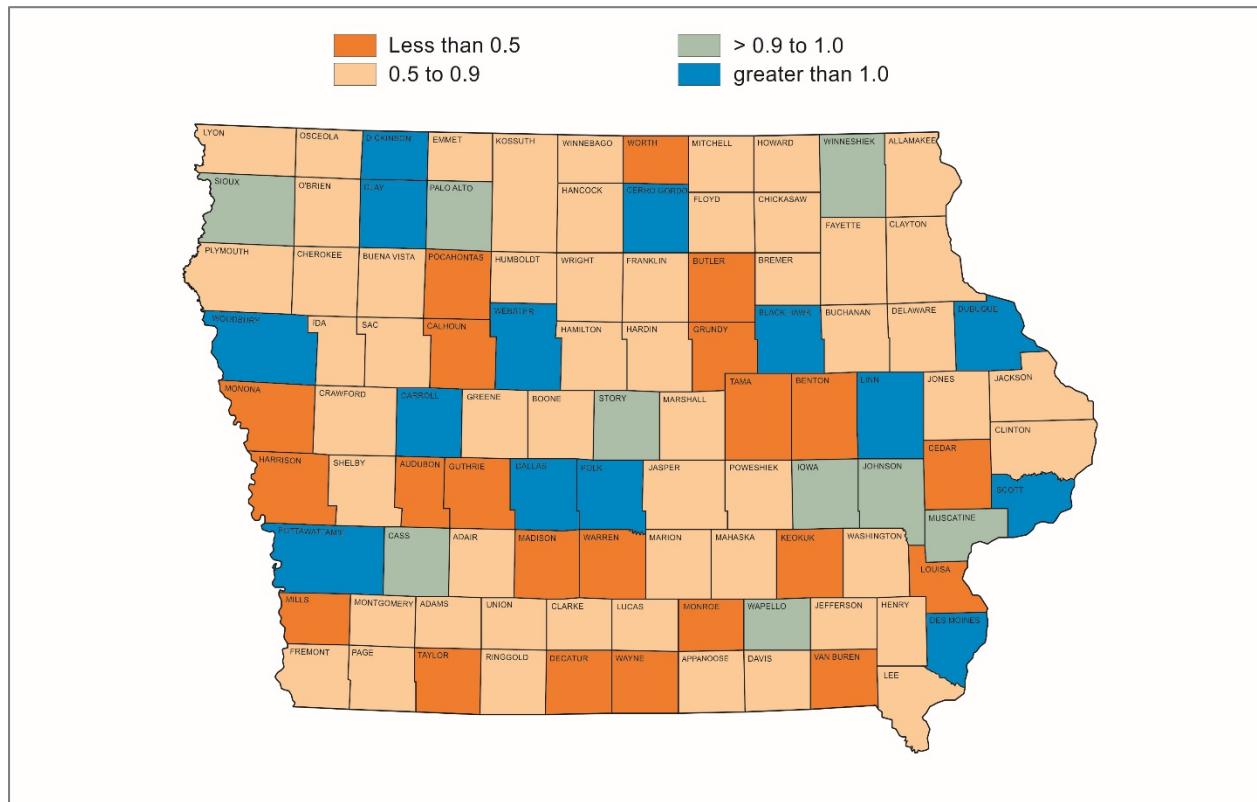
| Non-overlapping Categories | US Counties (N=1976) | Iowa Counties (N=99) |
|-----------------------------------|-----------------------------|-----------------------------|
| Farming-dependent | 19.8% | 26.3% |
| Mining-dependent | 9.3% | 0.0% |
| Manufacturing-dependent | 17.8% | 30.3% |
| Government-dependent | 12.0% | 3.0% |
| Recreation | 11.5% | 1.0% |
| Non-specialized | 29.6% | 39.4% |
| TOTAL | 100% | 100% |

Additional items from the USDA ERS data source include:

- Buena Vista and Crawford were the only Iowa counties in which more than 20% of its residents age 25 to 64 did not have a high school diploma or equivalent (2008-2012);
- No Iowa county was classified as having persistent poverty (i.e., 20% or more residents were poor as measured by the 1980, 1990, and 2000 censuses, plus the 2007-2011 American Community Survey [ACS] estimate);
- However, Ringgold had the distinction of being the only Iowa county with persistent child poverty, using the same census data and ACS estimate; and
- Dallas was the only Iowa county where the number of residents 60 years and older grew by 15% or more between the years 2000 and 2010.

⁸ Description and maps. County economic types. (2015 edition). County typology codes. US Department of Agriculture, Economic Research Service. <https://www.ers.usda.gov/data-products/county-typology-codes/descriptions-and-maps/> Updated: May 31, 2017.

Pull Factor



Source: Iowa State University Department of Economics, Retail Trade Analysis

Figure 1333. Iowa county pull factor: regional trade patterns, 2017

Generally, there are three measures that assess retail sales performance: trade surplus or leakage, trade area capture, and pull factor ratio.

Trade area capture estimates the number of consumers within an area for which the retail needs are satisfied. The trade area capture is determined by dividing the community's (e.g., county) actual total sales by the estimated mean annual retail needs of its residents. When the number is in excess of the population, then the trade area is seen to go beyond the county boundary. The opposite is true when the trade area either overlaps or is subsumed by a contiguous county.

In turn, pull factor ratio is created by dividing the trade area capture by the county population. A pull factor ratio of 1.0 indicates that the local merchants satisfy the retail demands of county residents. If the ratio is in excess of 1.0, it would indicate that merchants are drawing consumers from outside the county. A ratio below 1.0 indicates that local merchants cannot meet the county's retail needs.

Why is this important? There is ample literature that suggests consumers tend to select dentists who are near active consumer markets. Thus, it will probably be economically disadvantageous for a dentist to locate in a county where the pull factor ratio is low, all other factors considered.

Table 12. 30 largest Iowa cities, by population (based on 2016 US Census population estimates)

| Rank | City | Population 2016 | Population Change Since 2000 | County | County Seat? | Total Dentists 2016 | Private Practice Dentists 2016 | | | | |
|------|-----------------|-----------------|------------------------------|----------------------|--------------|---------------------|--------------------------------|-------------|------|-------|-----------|
| | | | | | | | GPs | Specialists | Solo | Group | Corporate |
| 1 | Des Moines | 215,472 | 16,790 | Polk, Warren | Y | 101 | 73 | 14 | 38 | 41 | 7 |
| 2 | Cedar Rapids | 131,127 | 10,369 | Linn | Y | 90 | 64 | 24 | 30 | 54 | 4 |
| 3 | Davenport | 102,612 | 4,253 | Scott | Y | 62 | 46 | 14 | 31 | 26 | 3 |
| 4 | Sioux City | 82,872 | -2,141 | Woodbury, Plymouth | Y | 54 | 39 | 9 | 17 | 24 | 6 |
| 5 | Iowa City | 74,398 | 12,178 | Johnson | Y | 109 | 29 | 11 | 16 | 22 | 2 |
| 6 | Waterloo | 67,934 | -813 | Black Hawk | Y | 40 | 28 | 8 | 16 | 18 | 2 |
| 7 | Ames | 66,191 | 15,460 | Story | | 37 | 25 | 11 | 10 | 24 | 2 |
| 8 | West Des Moines | 64,560 | 18,157 | Polk, Warren, Dallas | | 76 | 45 | 30 | 22 | 46 | 6 |
| 9 | Council Bluffs | 62,524 | 4,256 | Pottawattamie | Y | 43 | 30 | 11 | 14 | 20 | 7 |
| 10 | Ankeny | 58,627 | 31,510 | Polk | | 32 | 26 | 6 | 9 | 18 | 3 |
| 11 | Dubuque | 58,531 | 845 | Dubuque | Y | 61 | 39 | 19 | 11 | 44 | 3 |
| 12 | Urbandale | 43,018 | 13,946 | Polk, Dallas | | 19 | 17 | 2 | 7 | 12 | 0 |
| 13 | Cedar Falls | 41,390 | 5,245 | Black Hawk | | 24 | 16 | 8 | 13 | 10 | 1 |
| 14 | Marion | 38,480 | 12,186 | Linn | | 9 | 9 | 0 | 6 | 3 | 0 |
| 15 | Bettendorf | 35,727 | 4,452 | Scott | | 32 | 20 | 12 | 9 | 23 | 0 |
| 16 | Mason City | 27,430 | -1,742 | Cerro Gordo | Y | 22 | 17 | 5 | 7 | 14 | 1 |
| 17 | Marshalltown | 27,328 | 1,319 | Marshall | Y | 17 | 12 | 2 | 6 | 8 | 0 |
| 18 | Clinton | 25,719 | -2,053 | Clinton | Y | 20 | 14 | 4 | 5 | 13 | 0 |
| 19 | Burlington | 25,277 | -1,562 | Des Moines | Y | 11 | 8 | 3 | 6 | 5 | 0 |
| 20 | Ottumwa | 24,487 | -511 | Wapello | Y | 16 | 10 | 3 | 11 | 2 | 0 |
| 21 | Fort Dodge | 24,441 | -695 | Webster | Y | 15 | 9 | 5 | 9 | 3 | 2 |
| 22 | Muscatine | 23,914 | 1,217 | Muscatine | Y | 9 | 7 | 2 | 8 | 1 | 0 |
| 23 | Johnston | 21,114 | 12,465 | Polk | | 10 | 9 | 0 | 5 | 4 | 0 |
| 24 | Coralville | 20,397 | 5,274 | Johnson | | 28 | 14 | 9 | 10 | 12 | 1 |

| Rank | City | Population 2016 | Population Change Since 2000 | County | County Seat? | Total Dentists 2016 | Private Practice Dentists 2016 | | | | |
|------|---------------|-----------------|------------------------------|--------------|--------------|---------------------|--------------------------------|-------------|------|-------|-----------|
| | | | | | | | GPs | Specialists | Solo | Group | Corporate |
| 25 | Waukee | 19,284 | 14,158 | Dallas | | 5 | 4 | 1 | 1 | 4 | 0 |
| 26 | North Liberty | 18,520 | 13,153 | Johnson | | 10 | 7 | 3 | 1 | 9 | 0 |
| 27 | Altoona | 17,938 | 7,593 | Polk | | 7 | 6 | 1 | 4 | 2 | 0 |
| 28 | Clive | 17,546 | 4,691 | Dallas, Polk | | 9 | 9 | 0 | 5 | 2 | 2 |
| 29 | Indianola | 15,785 | 2,787 | Warren | Y | 8 | 8 | 0 | 3 | 5 | 0 |
| 30 | Newton | 15,034 | -545 | Jasper | Y | 11 | 7 | 3 | 5 | 2 | 2 |

Since 2000, 22 of the 30 largest cities in Iowa gained population. Of these cities, 17 are county seats.

In 2016, 64.5% of all Iowa dentists – including 62% of private practitioners -- were located in these 30 cities. Of private practitioners in these communities, 57% and 84.3% were general practice dentists and dental specialists, respectively.

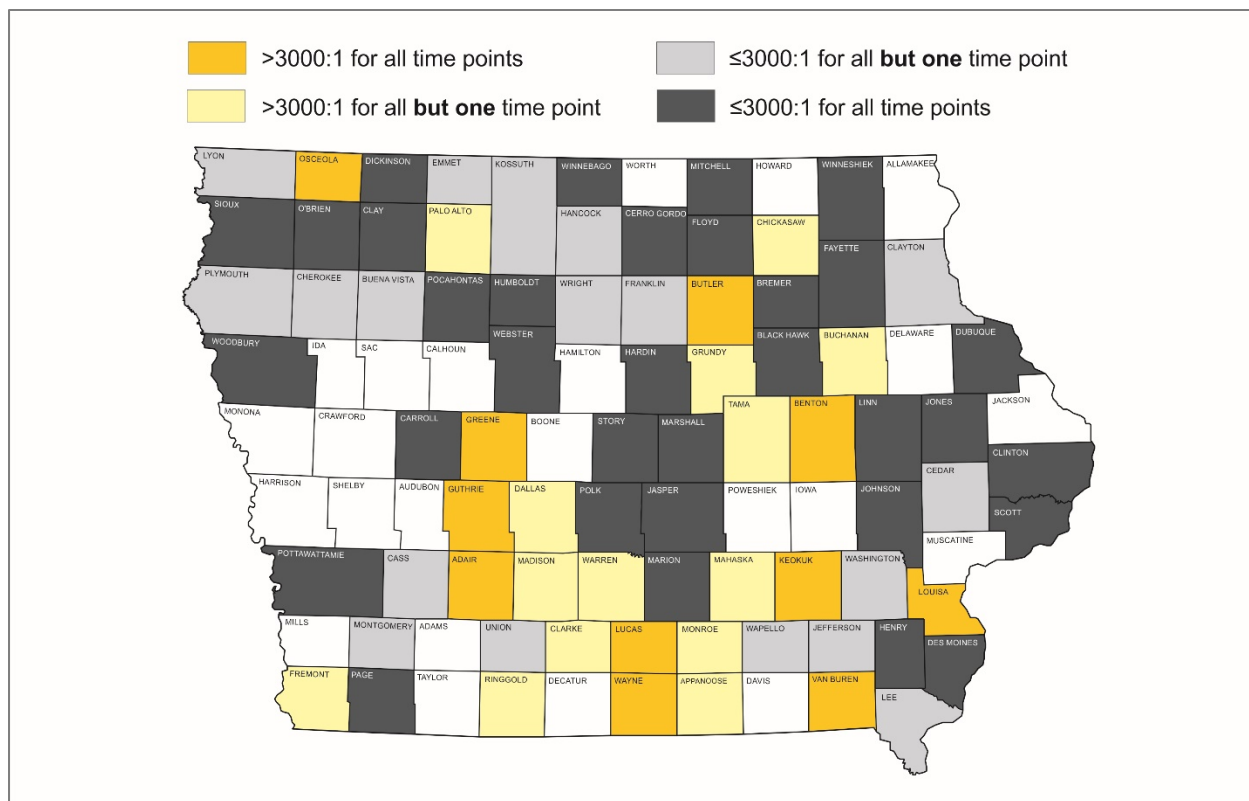


Figure 1344. County population-to-dentist ratio trends, 1965 through 2016

This figure displays 4 different levels of population-to-dentist ratios during the past half century:

1. Counties where the population-to-dentist ratio exceeded 3,000:1 for each of the sentinel years (n=11);
2. Counties where the population-to-dentist ratio exceeded 3,000:1 for 5 of the 6 sentinel years (n=14);
3. Counties where the population-to-dentist ratio was less than or equal to 3,000:1 for 5 of the 6 sentinel years (n=18); and
4. Counties where the population-to-dentist ratio was less than or equal to 3,000:1 for each of the sentinel years (n=33).

This graph visually demonstrates which counties persistently were at the higher and lower ends of the population-to-dentist spectrum. Although it may be altruistic to select those counties with the highest population-to-dentist ratios for dentist recruitment efforts, it might be more prudent to concentrate efforts for those counties where both recruitment and retention are most likely to occur.

Two counties, Butler and Van Buren, had a population-to-dentist ratio of greater than 5,000:1 for each of the sentinel years. Conversely, Johnson County was always below 1,000:1.

Historical Population-to-Dentist Ratios, Mid-1960s and Forward

This section contains county population-to-dentist ratios for a period slightly more than 50 years. Although sentinel years are not exactly at 10-year increments, nonetheless they provide a good indicator of dentist availability. Note that the years 1965, 1976, and 1986 used different resources for their numbers (see data sources below).

The statewide range for population-to-dentist ratio was from 1,974:1 (1997) to 2,390:1 (1976). During the 20-year period for this review, the ratio has been stable, only varying from 1,974:1 (1997) to 2,069:1 (2008),

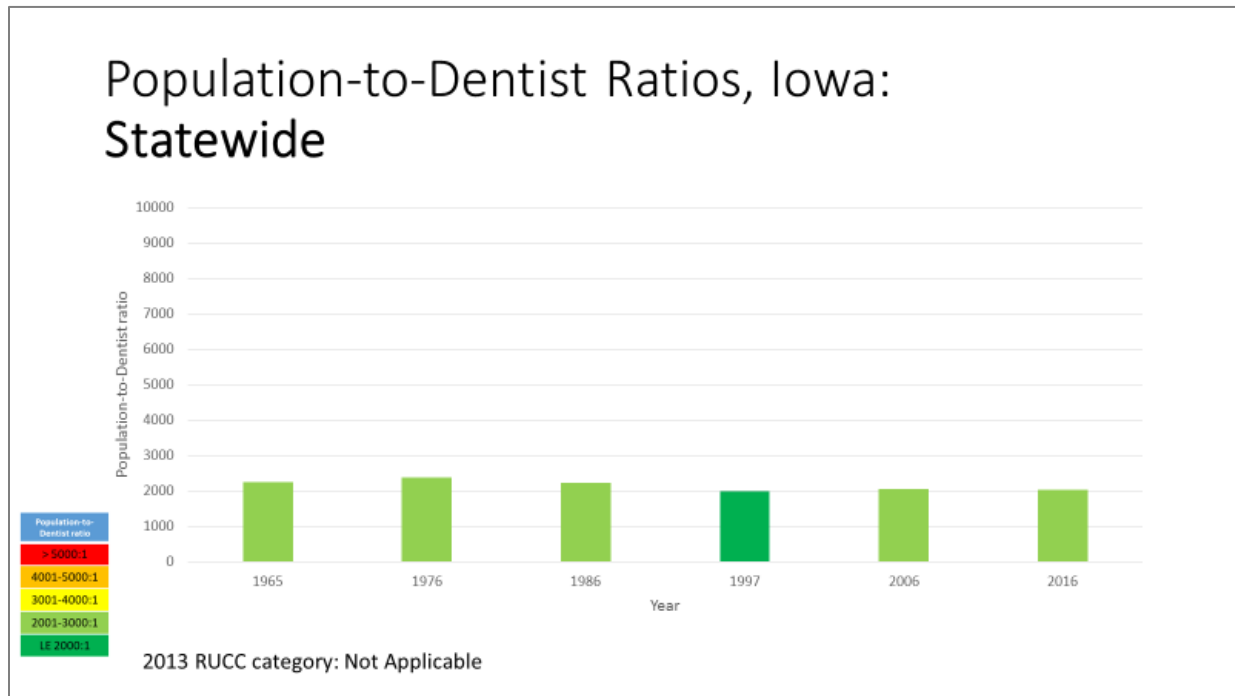


Figure 1355. Historical population-to-dentist ratios, Iowa counties, mid-1960s and forward.

| Color | Population-to-Dentist ratio |
|-------------|-----------------------------|
| Red | > 5,000:1 |
| Orange | 4,001-5,000:1 |
| Yellow | 3,001-4,000:1 |
| Light Green | 2,001-3,000:1 |
| Dark Green | < 2,000:1 |

Data Sources:

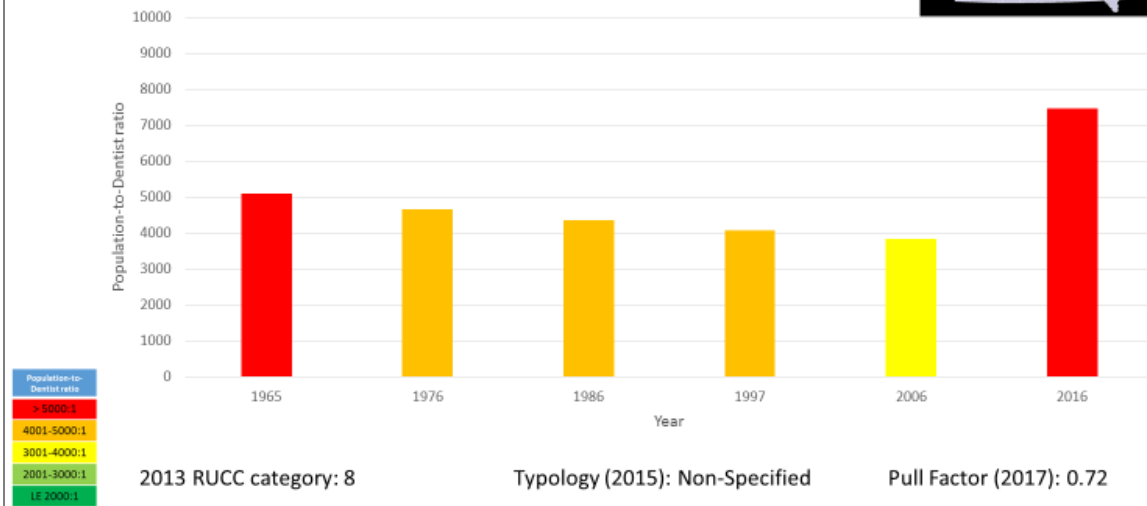
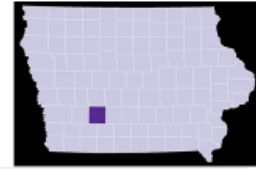
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1976. Robbins MH, Talbott I, Dohrmann R. *Iowa Health Manpower Plan: 1976-77*. #77-620030. US Public Health Service, Department of Health, Education, and Welfare; December 1977.

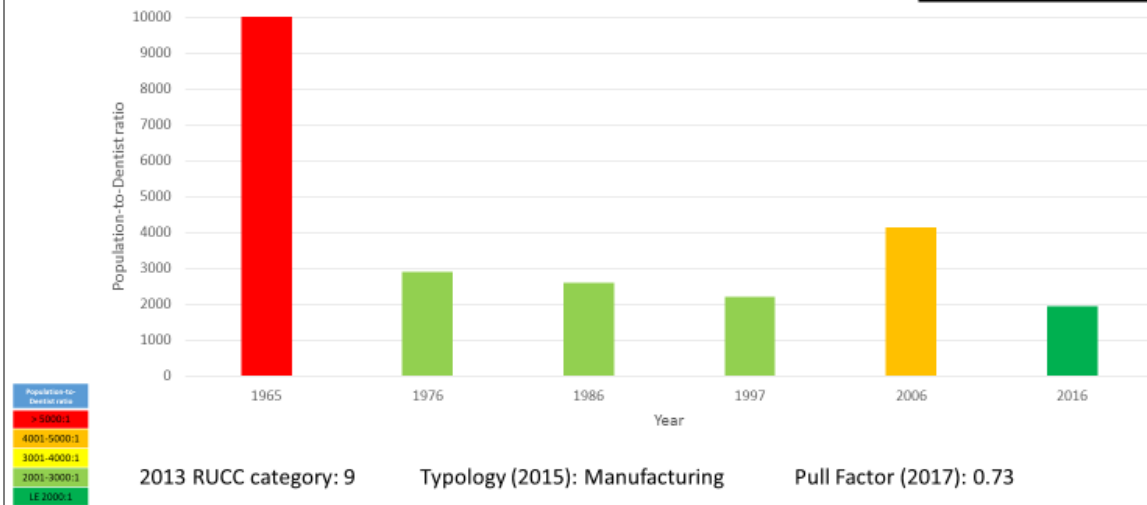
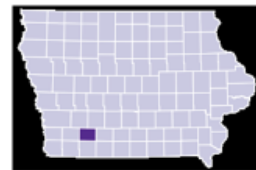
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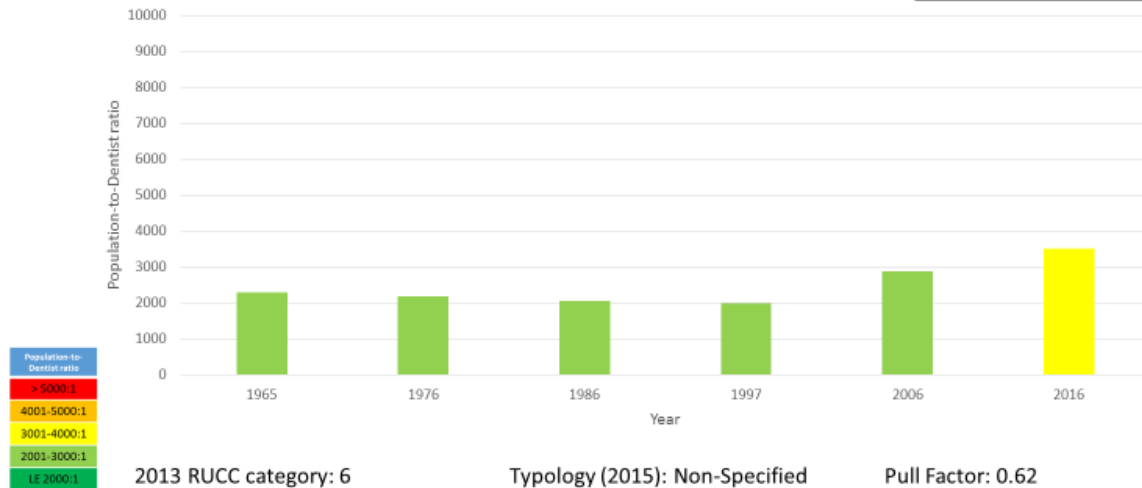
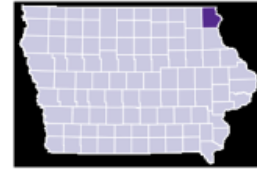
Population-to-Dentist Ratios, Iowa: Adair County



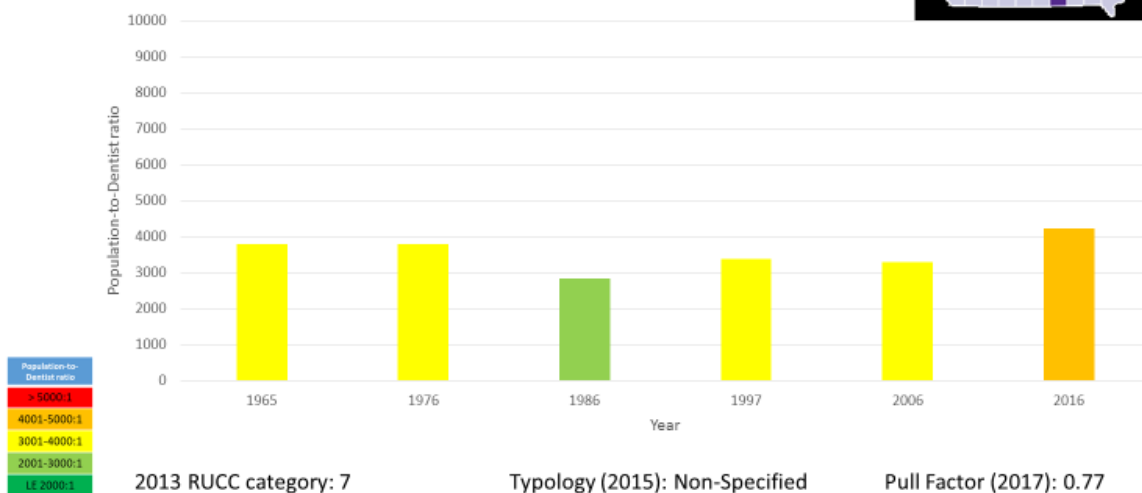
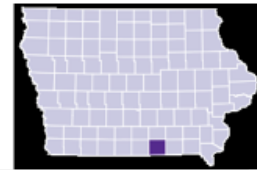
Population-to-Dentist Ratios, Iowa: Adams County



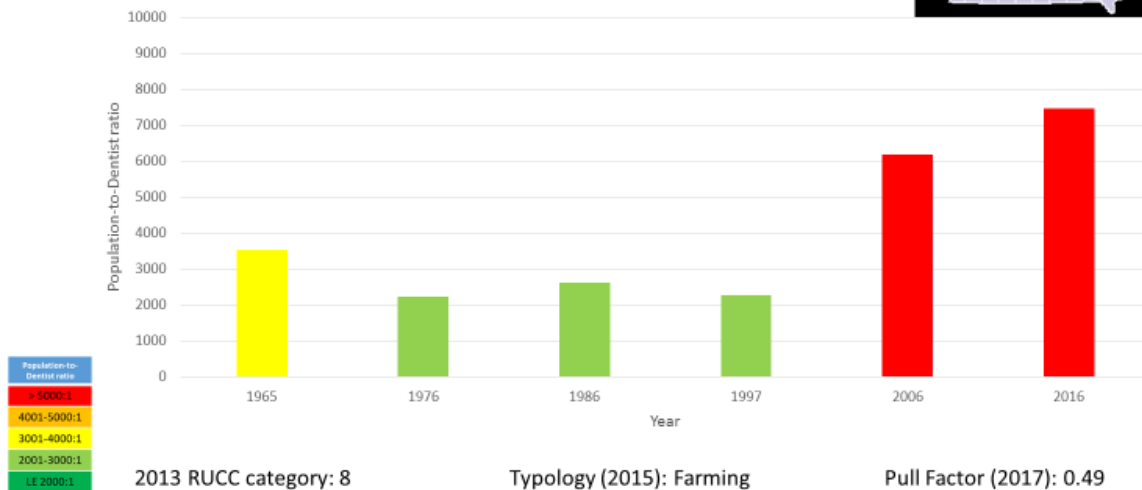
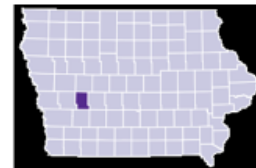
Population-to-Dentist Ratios, Iowa: Allamakee County



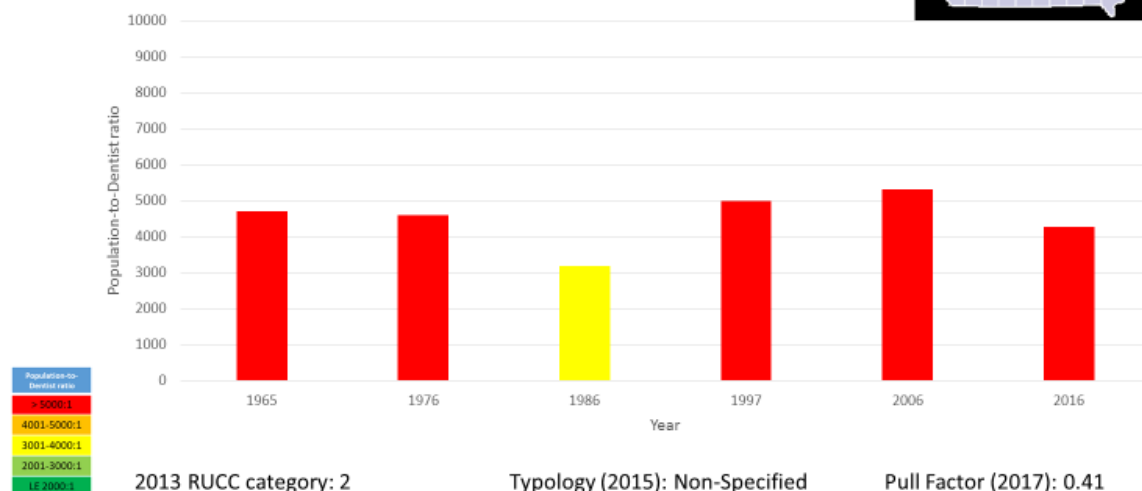
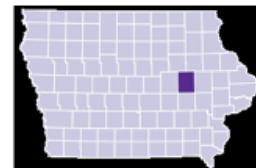
Population-to-Dentist Ratios, Iowa: Appanoose County



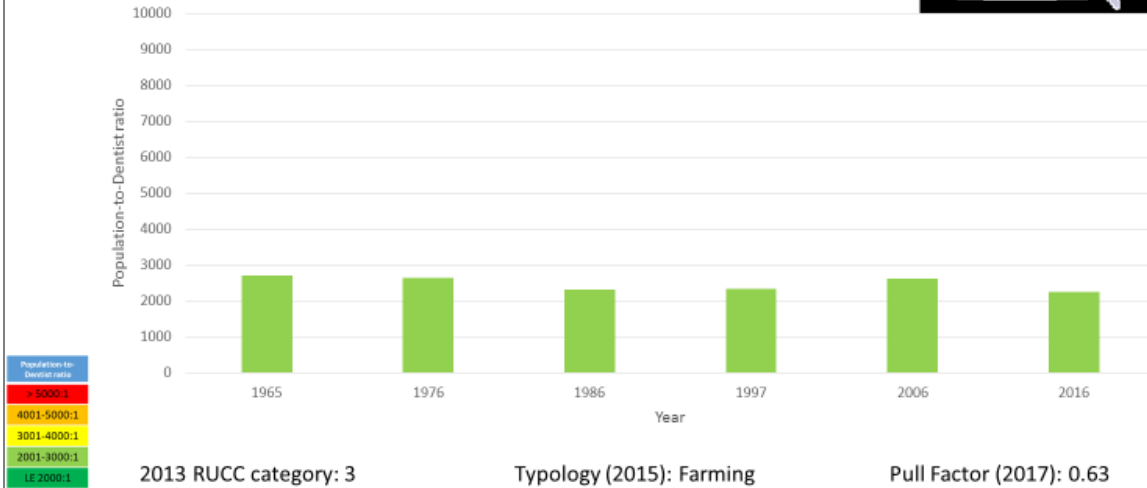
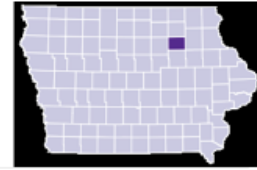
Population-to-Dentist Ratios, Iowa: Audubon County



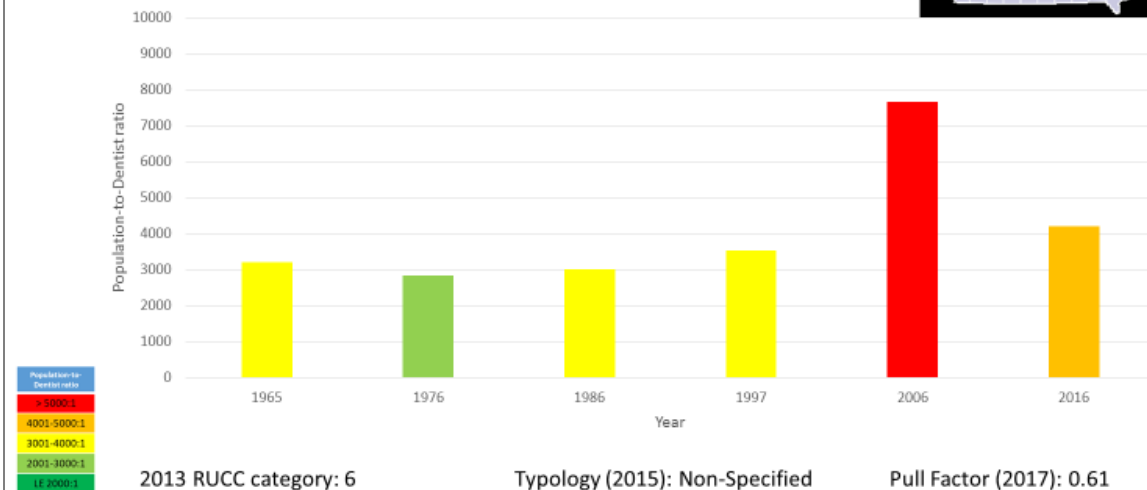
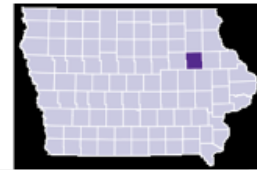
Population-to-Dentist Ratios, Iowa: Benton County



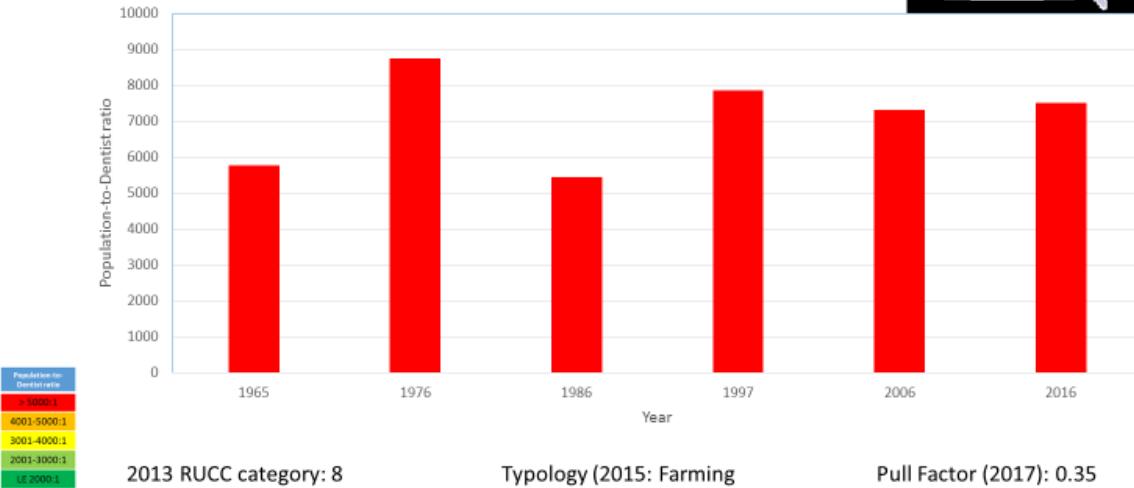
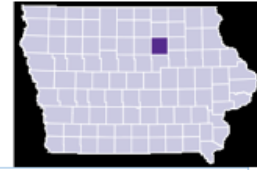
Population-to-Dentist Ratios, Iowa: Bremer County



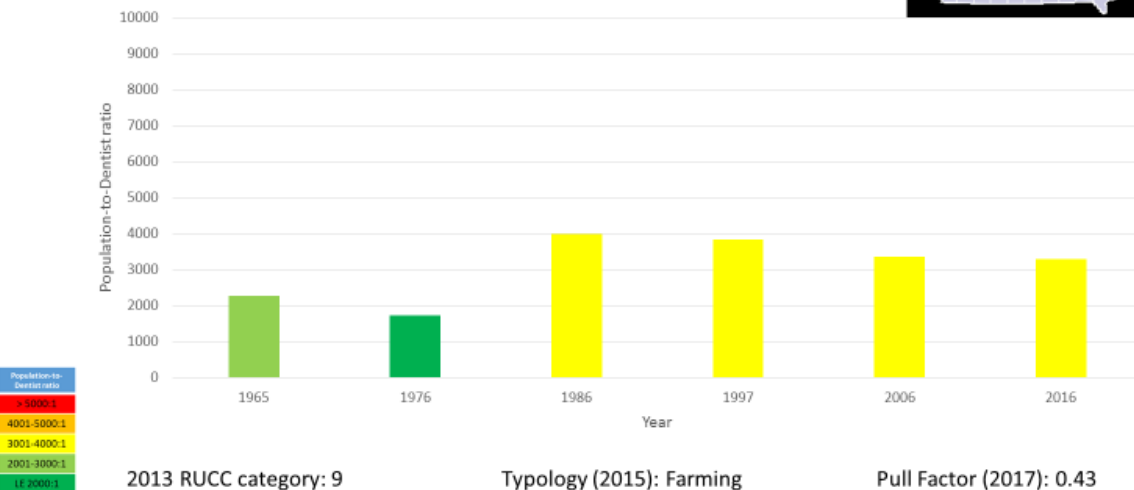
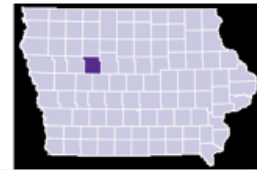
Population-to-Dentist Ratios, Iowa: Buchanan County



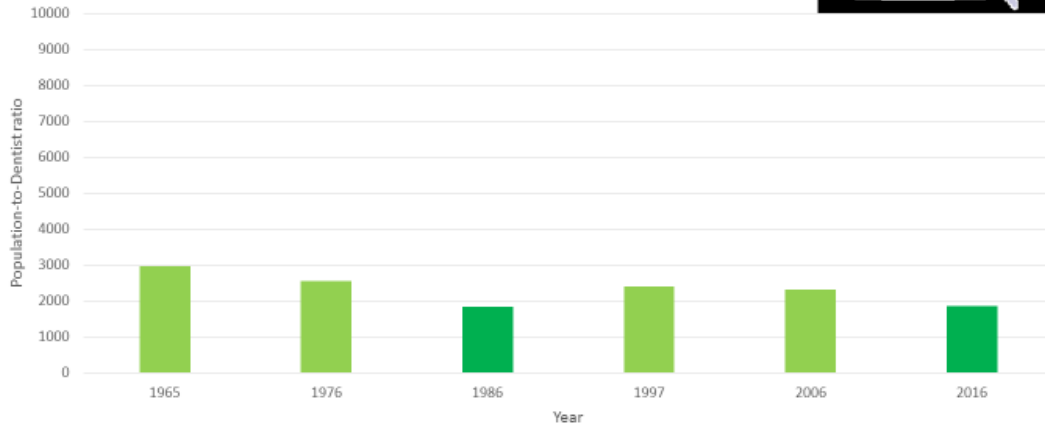
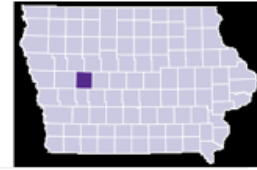
Population-to-Dentist Ratios, Iowa: Butler County



Population-to-Dentist Ratios, Iowa: Calhoun County



Population-to-Dentist Ratios, Iowa: Carroll County

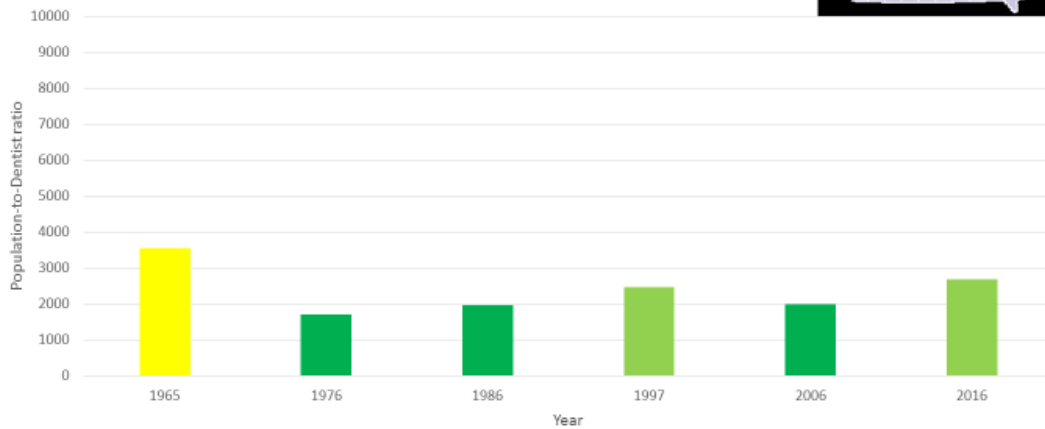
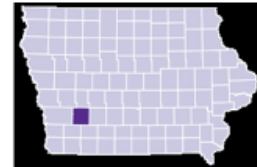


2013 RUCC category: 7

Typology (2015): Non-Specified

Pull Factor (2017): 1.21

Population-to-Dentist Ratios, Iowa: Cass County

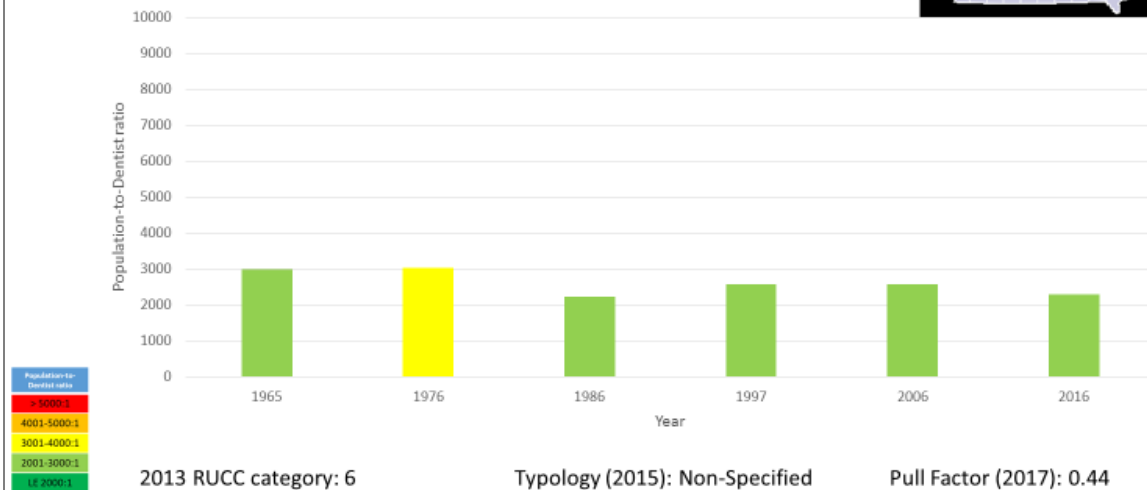
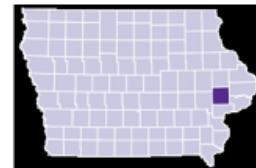


2013 RUCC category: 6

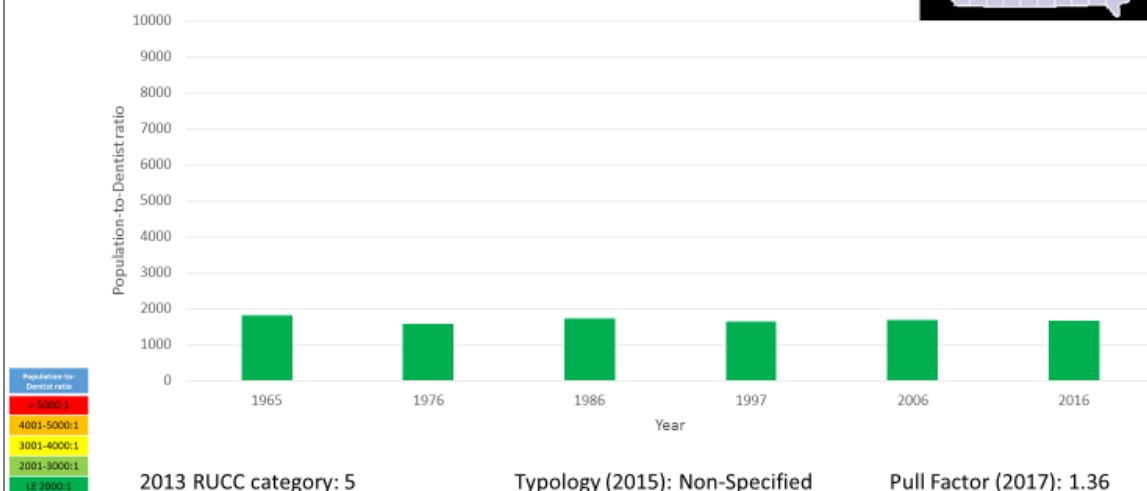
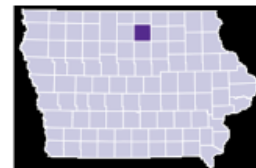
Typology (2015): Non-Specified

Pull Factor (2017): 0.96

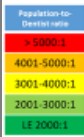
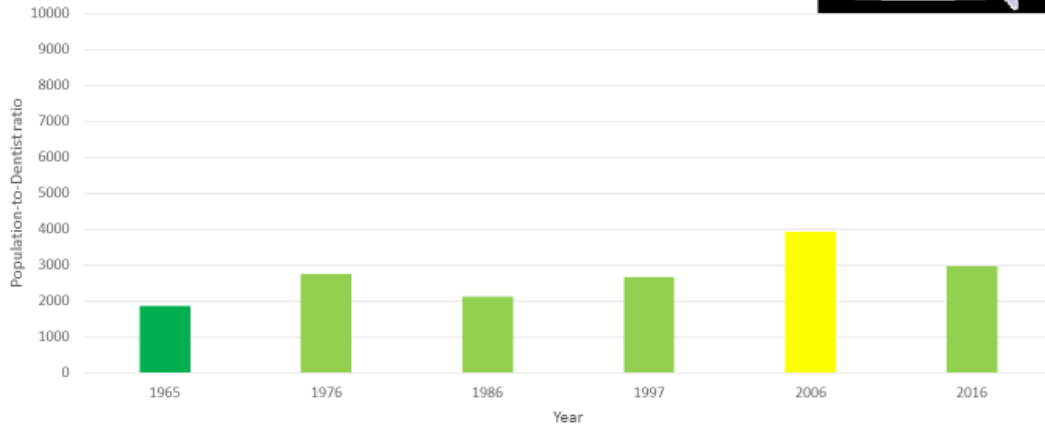
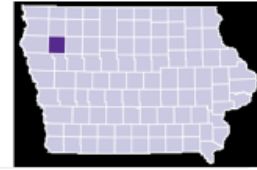
Population-to-Dentist Ratios, Iowa: Cedar County



Population-to-Dentist Ratios, Iowa: Cerro Gordo County



Population-to-Dentist Ratios, Iowa: Cherokee County

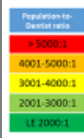
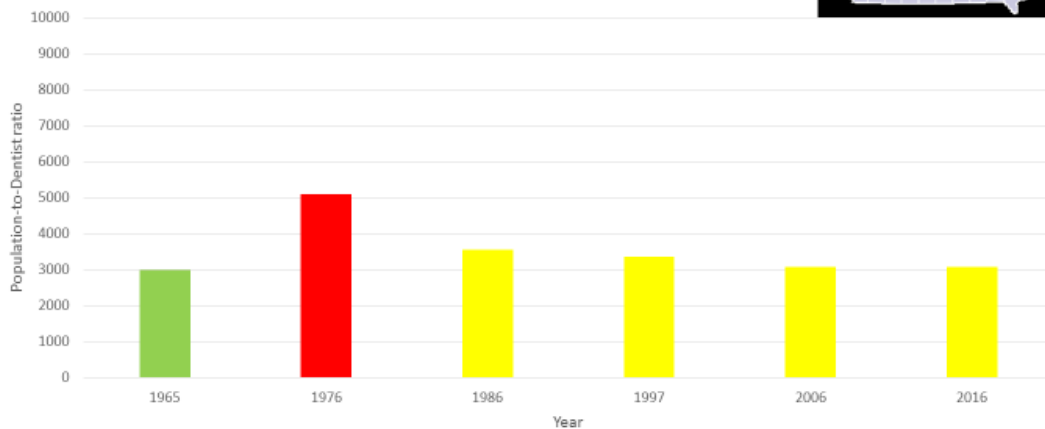
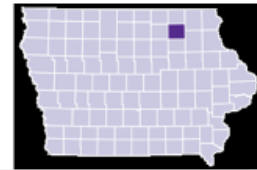


2013 RUCC category: 6

Typology (2015): Manufacturing

Pull Factor (2017): 0.76

Population-to-Dentist Ratios, Iowa: Chickasaw County

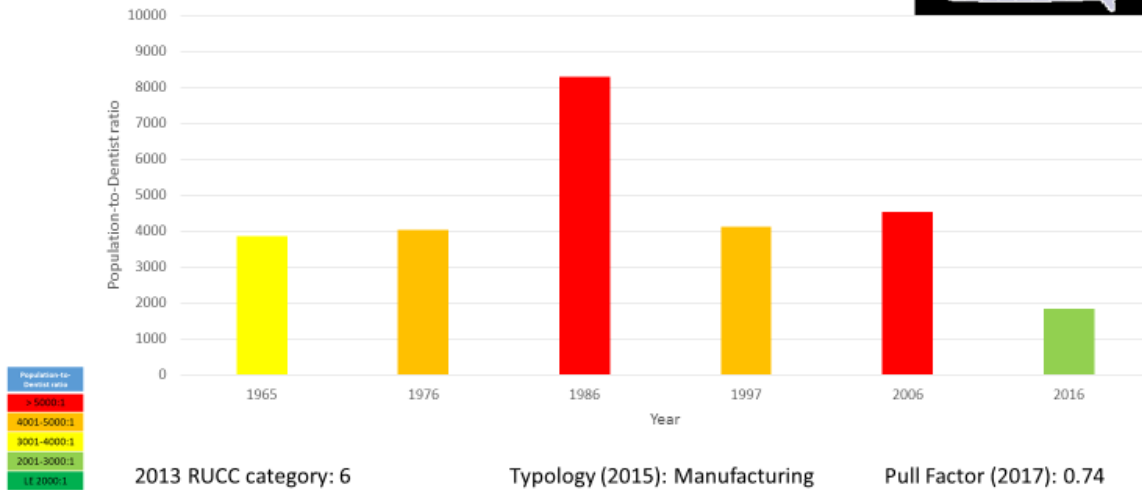
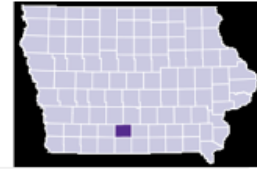


2013 RUCC category: 6

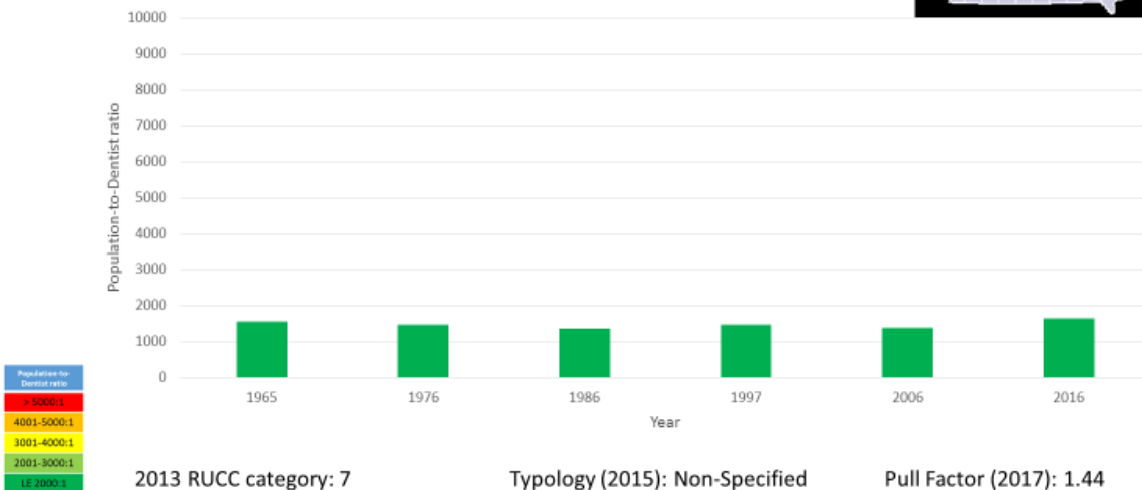
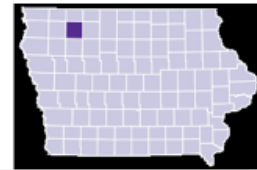
Typology (2015): Manufacturing

Pull Factor (2017): 0.62

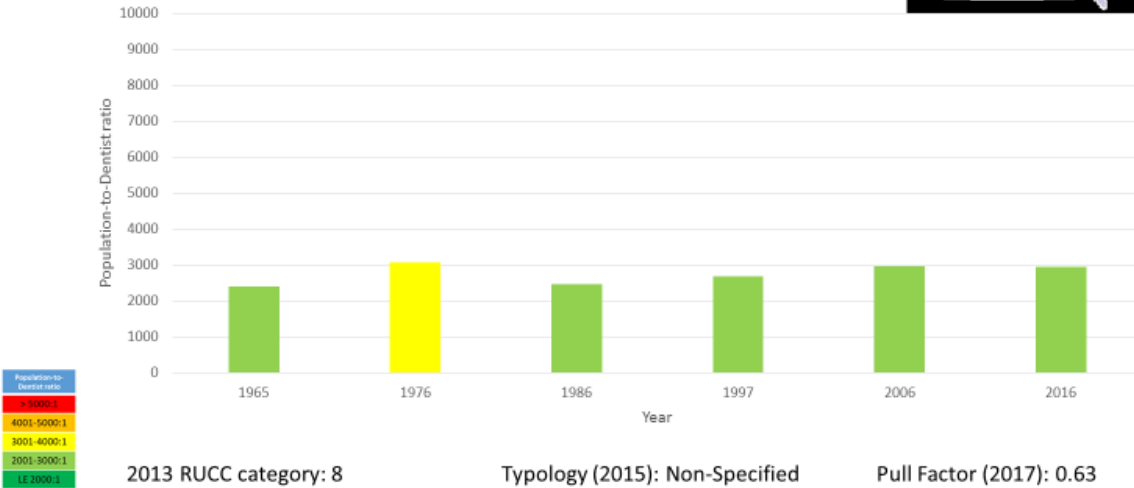
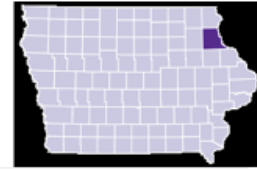
Population-to-Dentist Ratios, Iowa: Clarke County



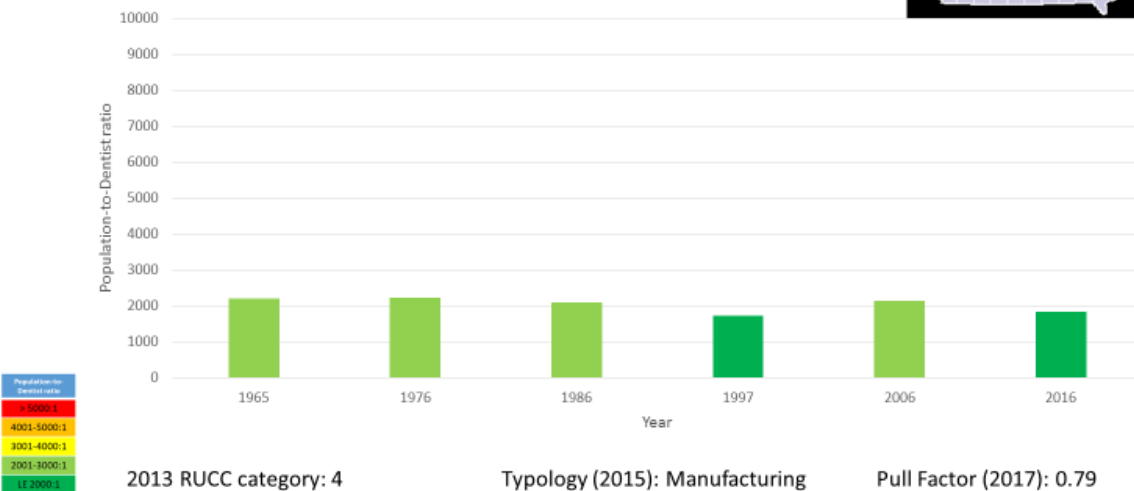
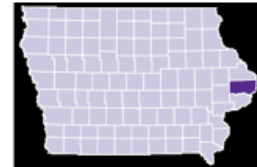
Population-to-Dentist Ratios, Iowa: Clay County



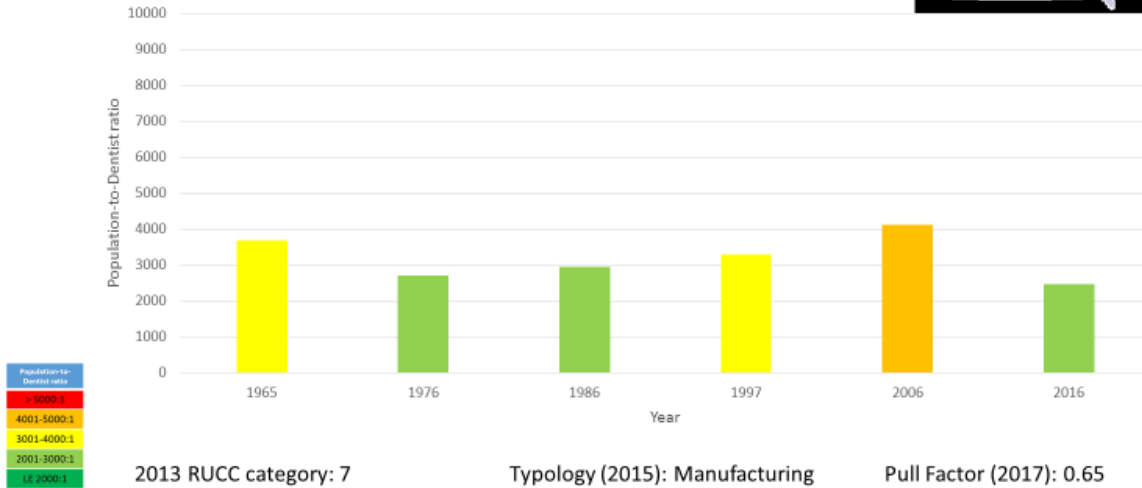
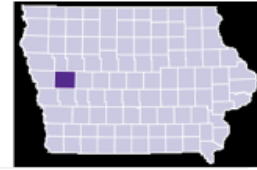
Population-to-Dentist Ratios, Iowa: Clayton County



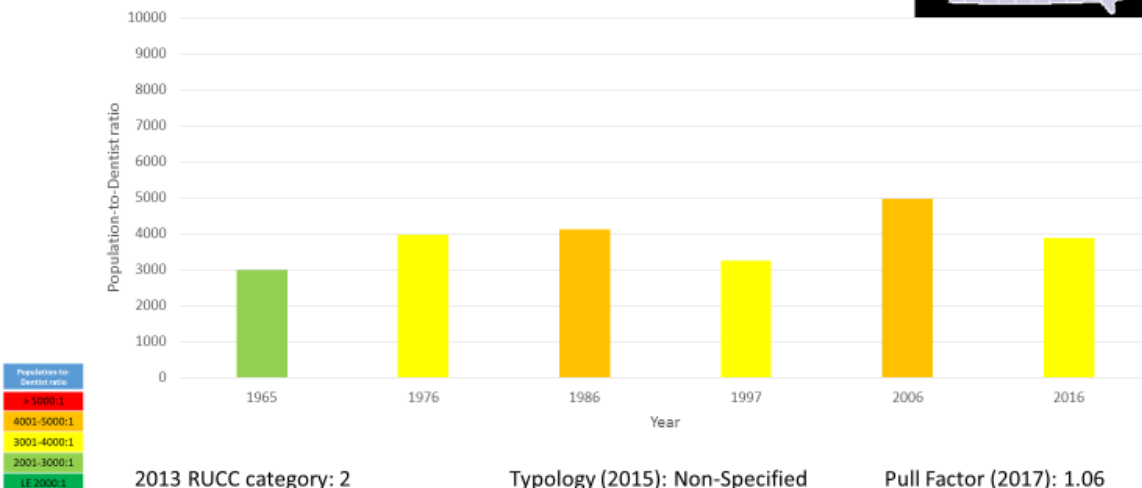
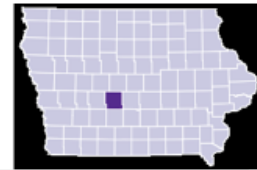
Population-to-Dentist Ratios, Iowa: Clinton County



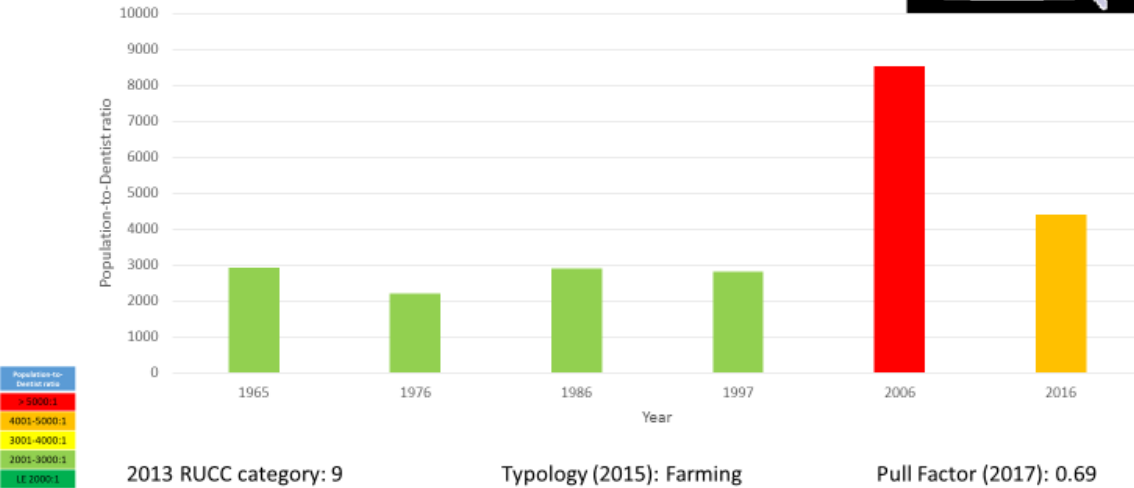
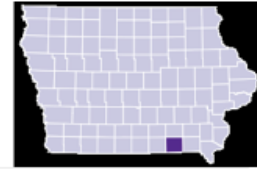
Population-to-Dentist Ratios, Iowa: Crawford County



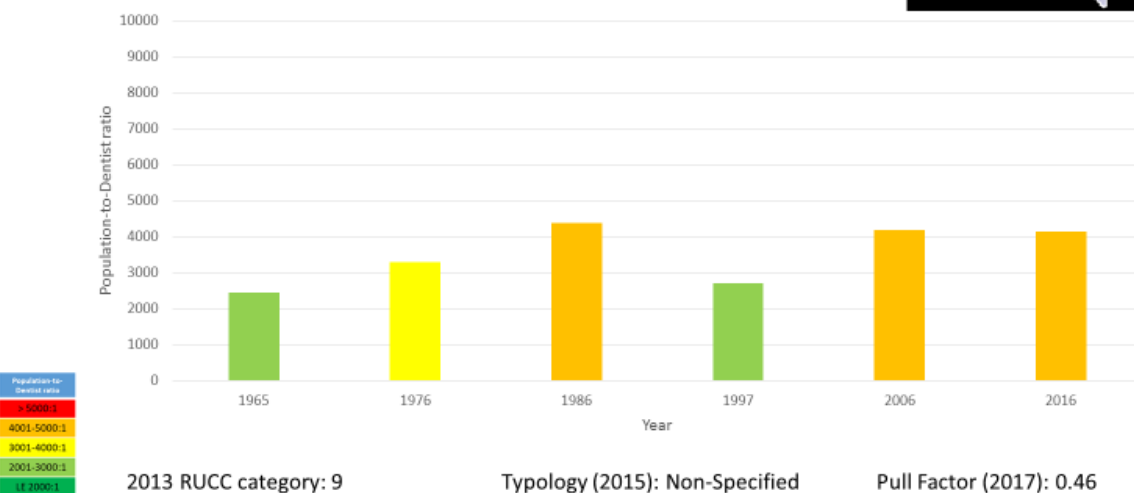
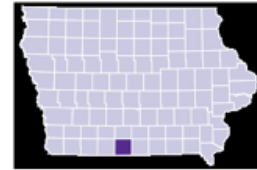
Population-to-Dentist Ratios, Iowa: Dallas County



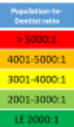
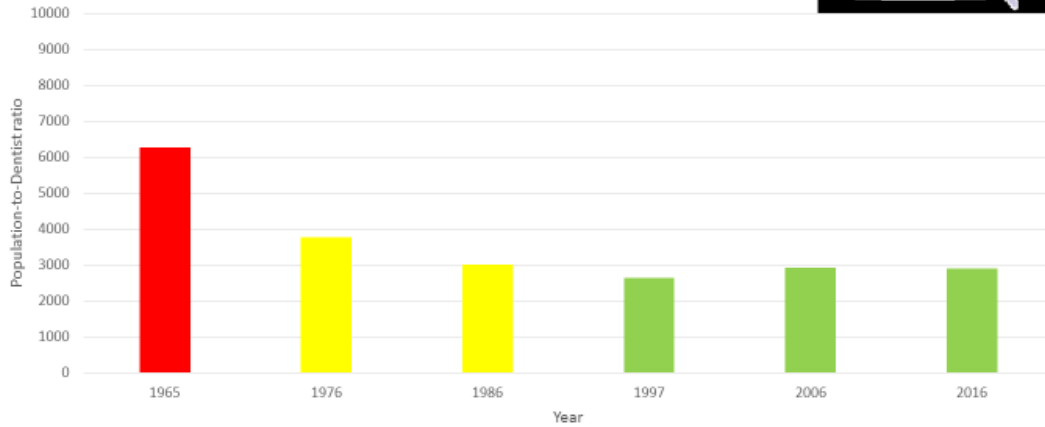
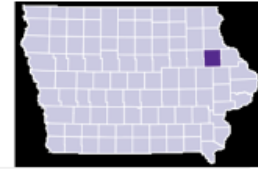
Population-to-Dentist Ratios, Iowa: Davis County



Population-to-Dentist Ratios, Iowa: Decatur County



Population-to-Dentist Ratios, Iowa: Delaware County

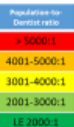
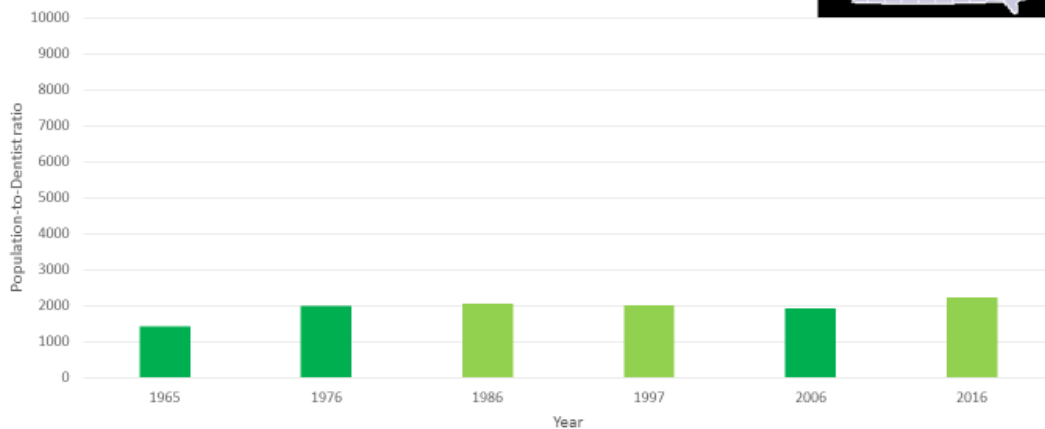
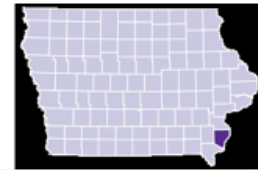


2013 RUCC category: 6

Typology (2015): Manufacturing

Pull Factor (2017): 0.65

Population-to-Dentist Ratios, Iowa: Des Moines County

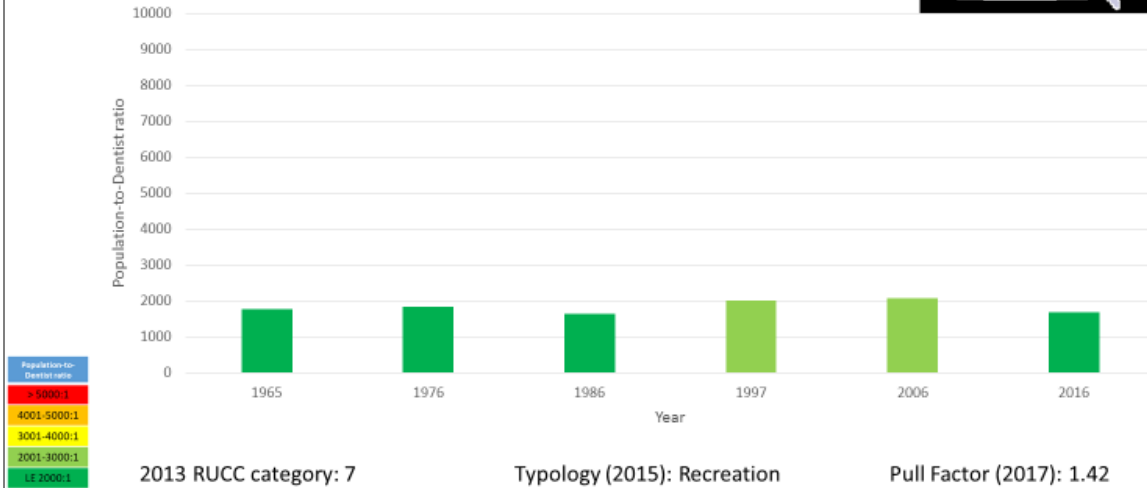
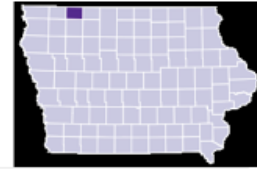


2013 RUCC category: 5

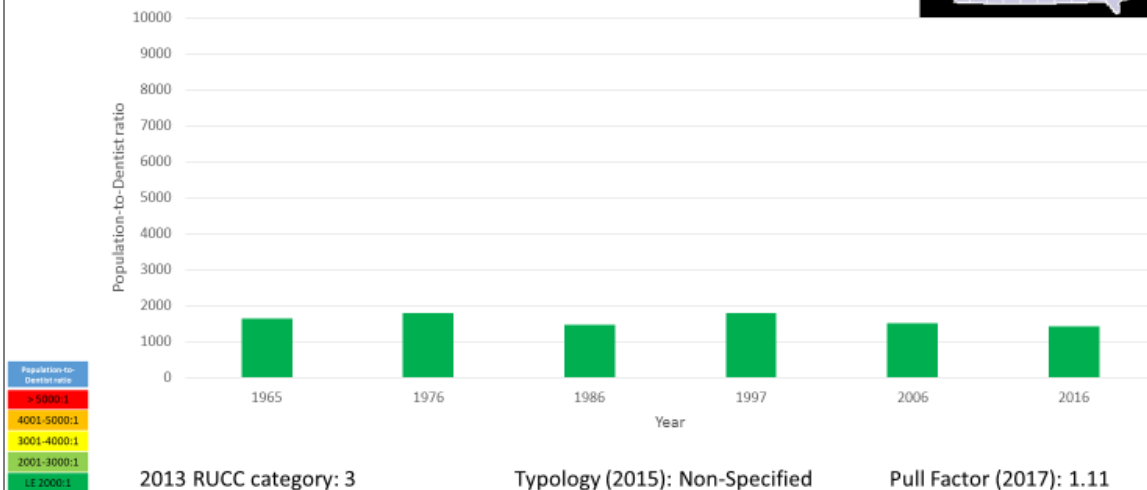
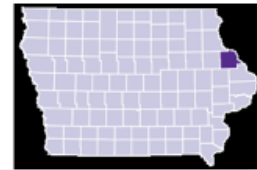
Typology (2015): Manufacturing

Pull Factor (2017): 1.23

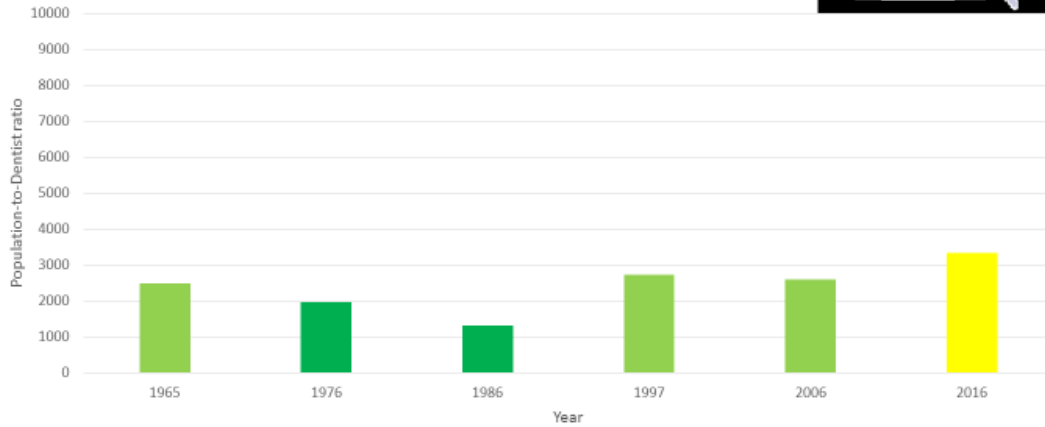
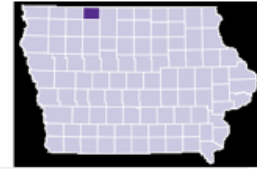
Population-to-Dentist Ratios, Iowa: Dickinson County



Population-to-Dentist Ratios, Iowa: Dubuque County



Population-to-Dentist Ratios, Iowa: Emmet County

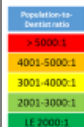
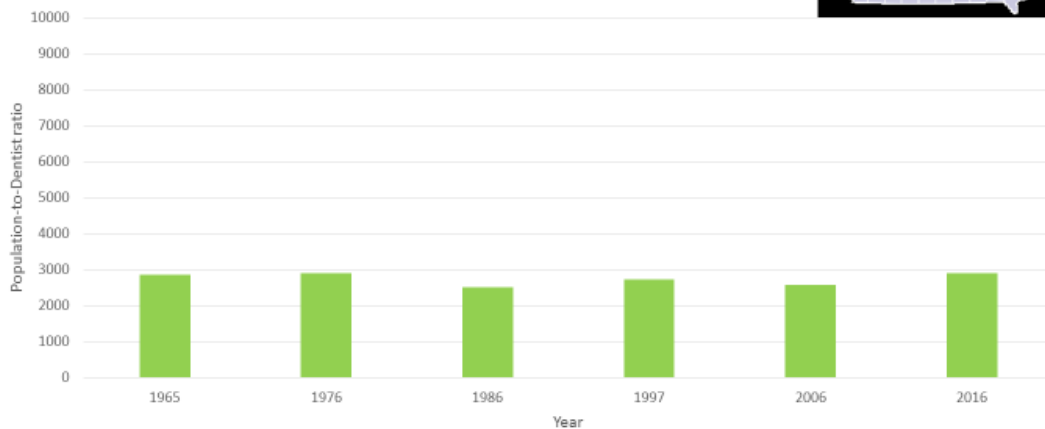
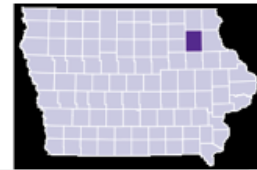


2013 RUCC category: 7

Typology (2015): Non-Specified

Pull Factor (2017): 0.70

Population-to-Dentist Ratios, Iowa: Fayette County

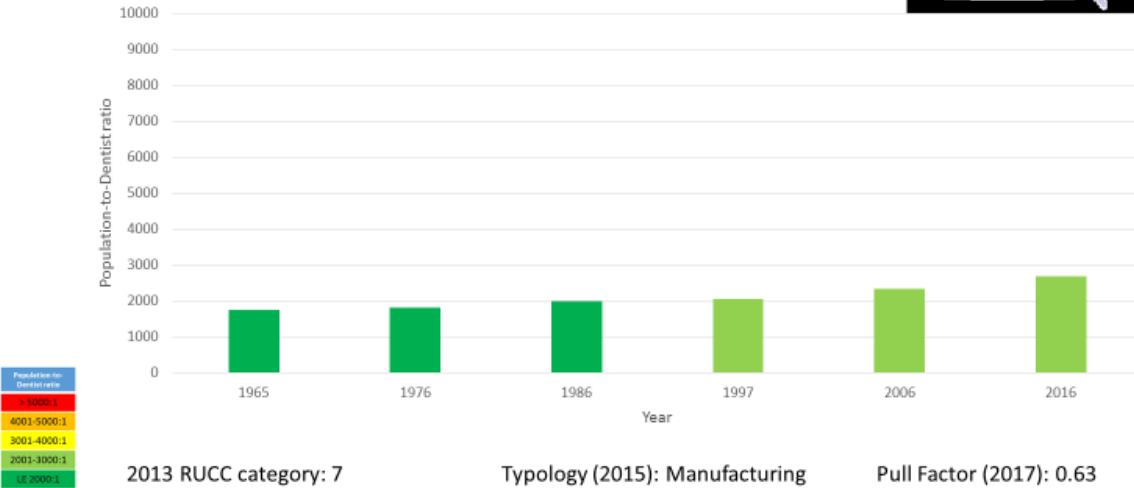
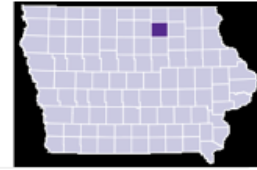


2013 RUCC category: 6

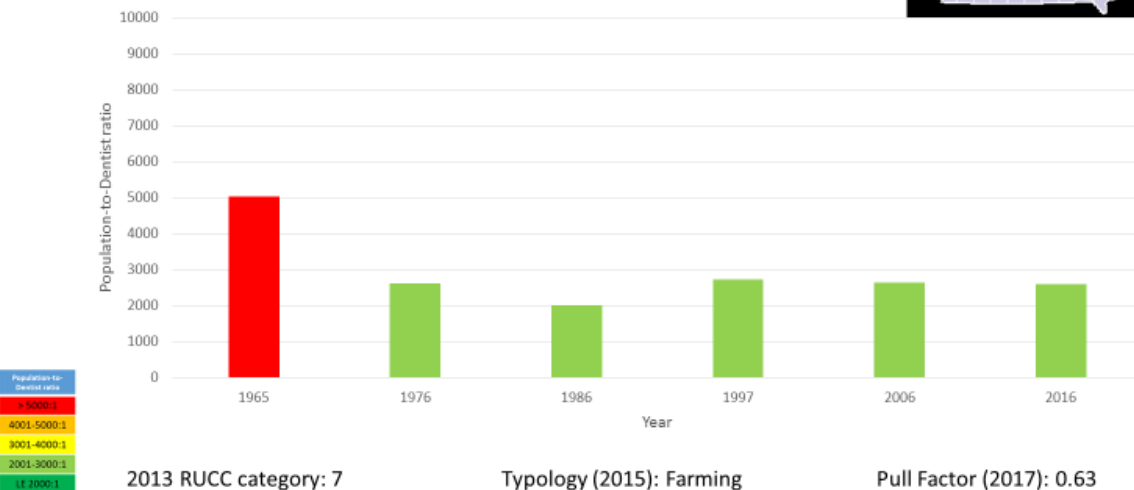
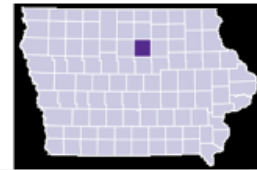
Typology (2015): Non-Specified

Pull Factor (2017): 0.55

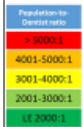
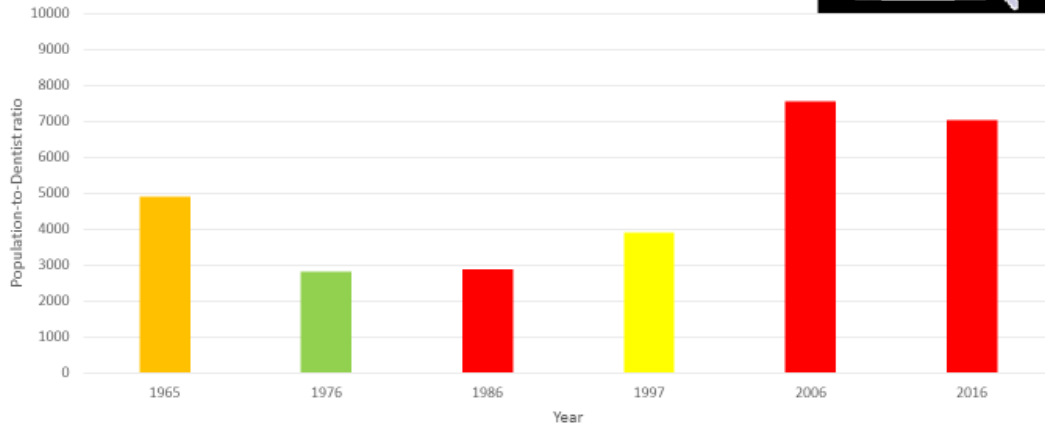
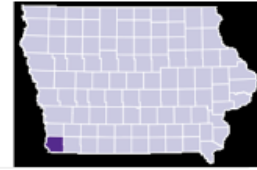
Population-to-Dentist Ratios, Iowa: Floyd County



Population-to-Dentist Ratios, Iowa: Franklin County



Population-to-Dentist Ratios, Iowa: Fremont County

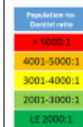
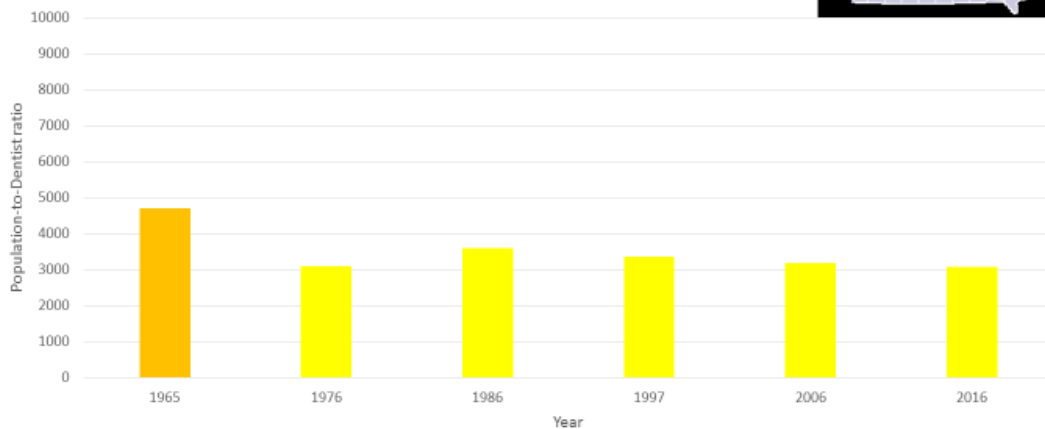
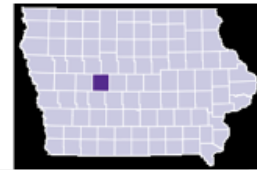


2013 RUCC category: 8

Typology (2015): Manufacturing

Pull Factor (2017): 0.58

Population-to-Dentist Ratios, Iowa: Greene County

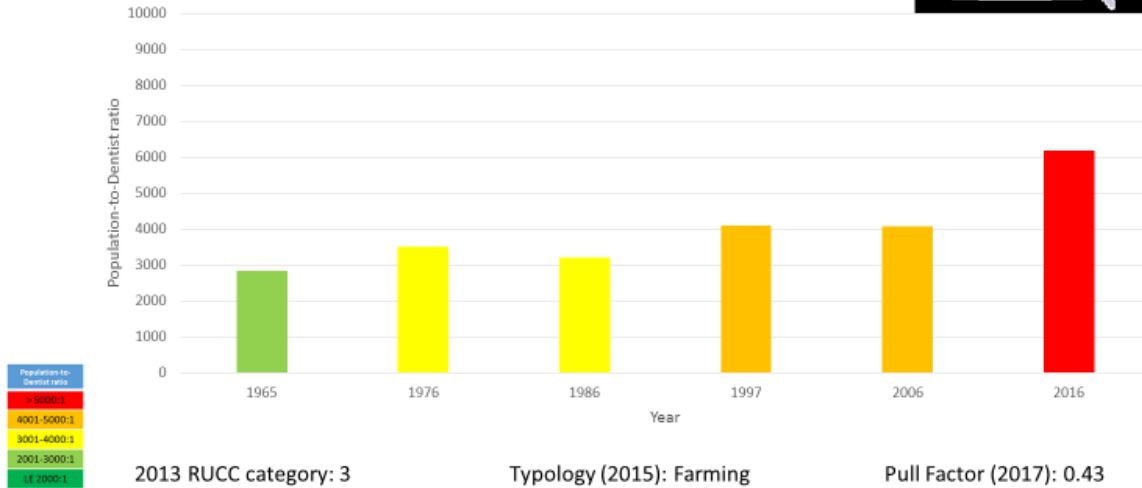
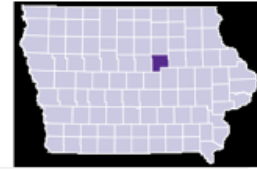


2013 RUCC category: 6

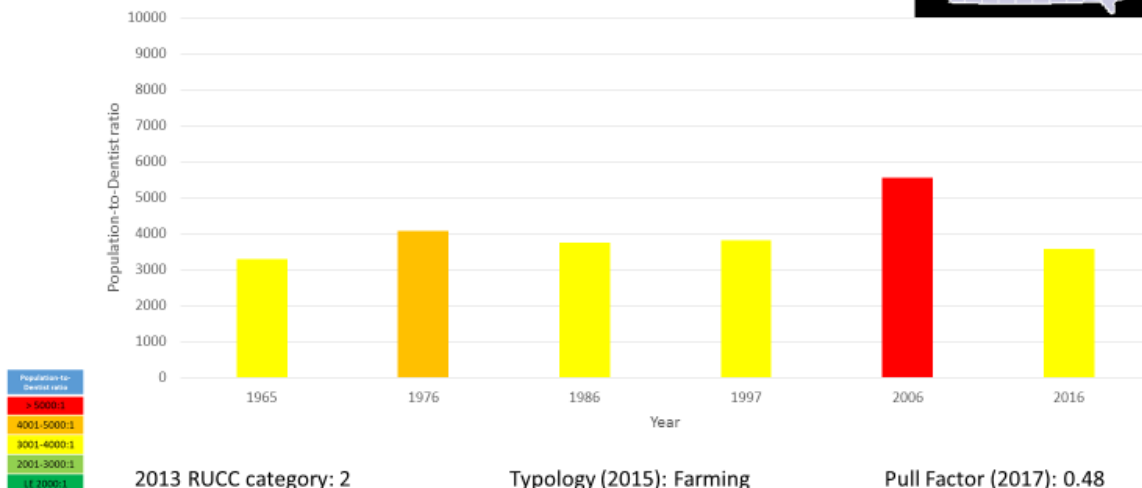
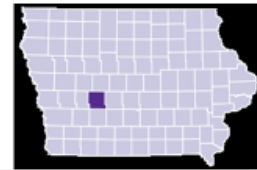
Typology (2015): Farming

Pull Factor (2017): 0.75

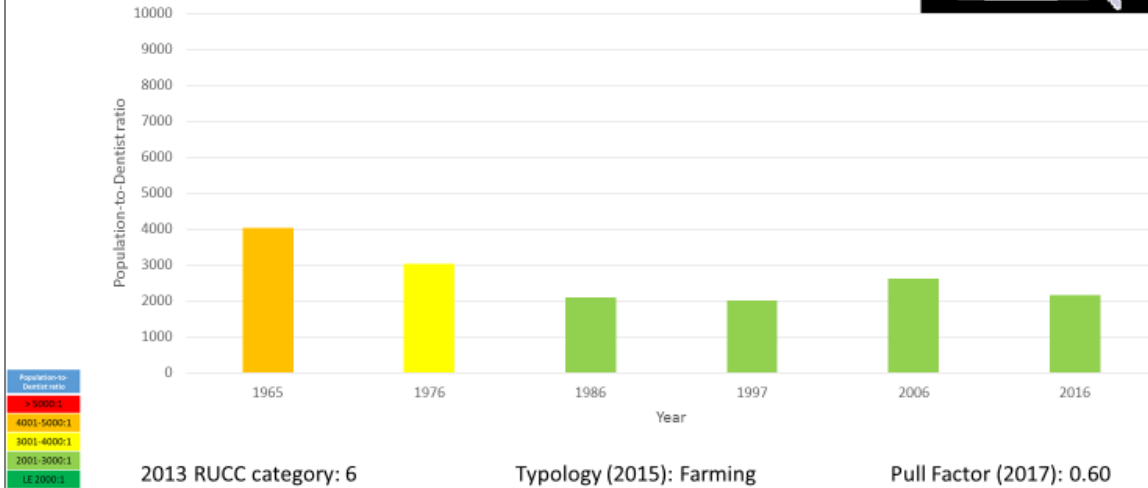
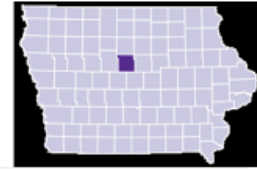
Population-to-Dentist Ratios, Iowa: Grundy County



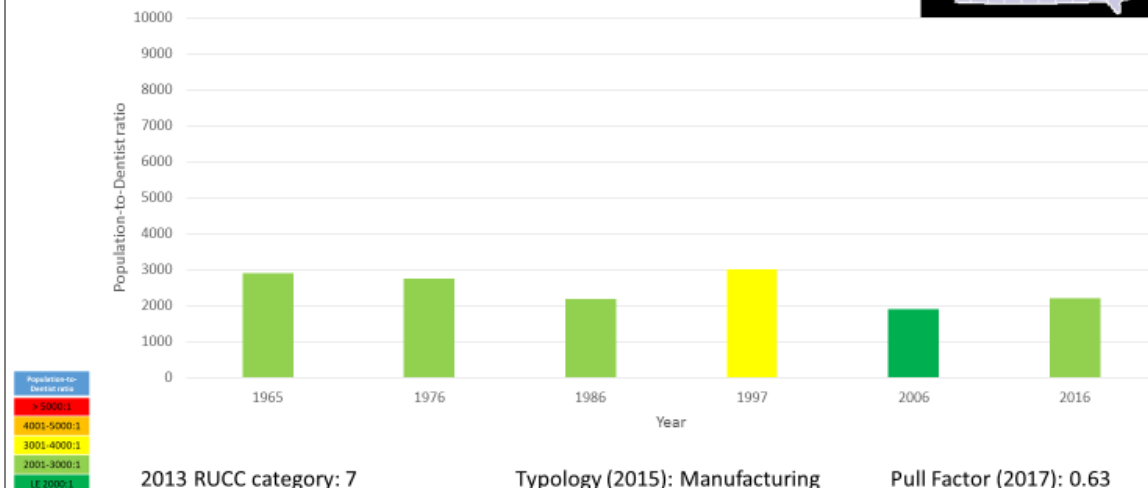
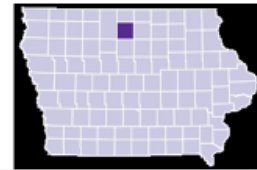
Population-to-Dentist Ratios, Iowa: Guthrie County



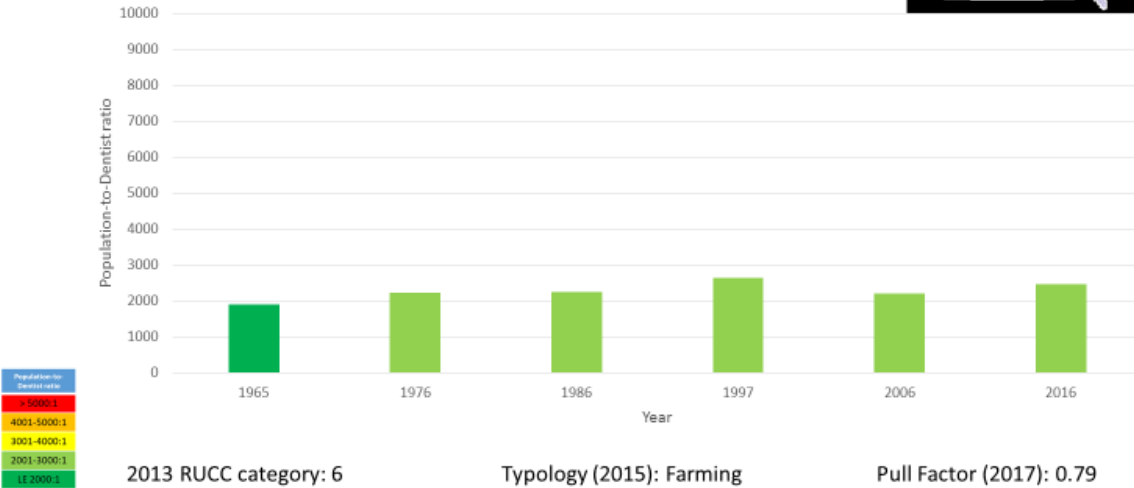
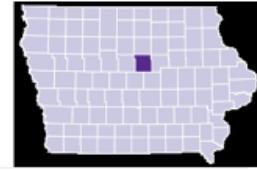
Population-to-Dentist Ratios, Iowa: Hamilton County



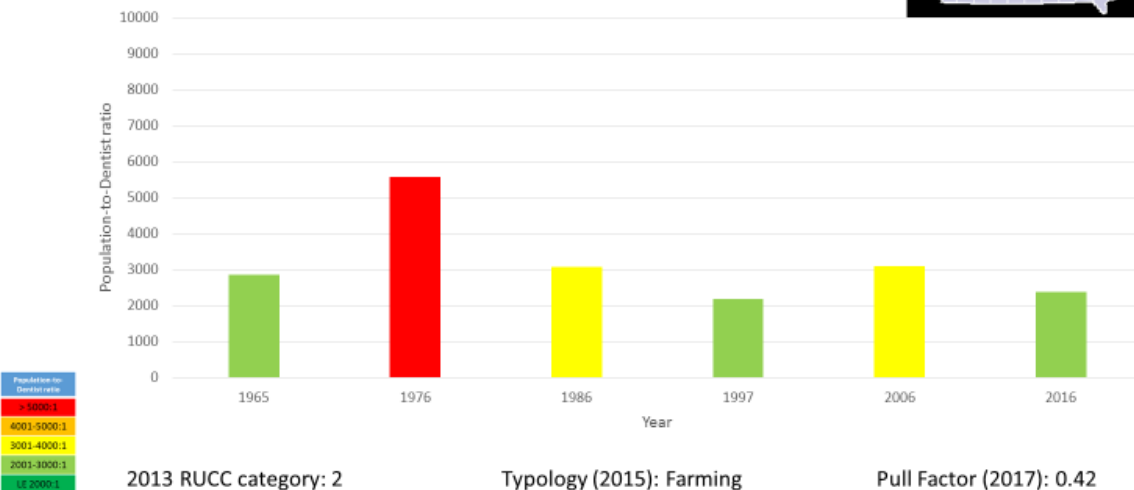
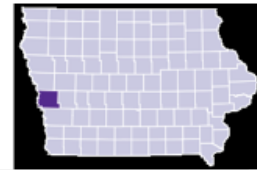
Population-to-Dentist Ratios, Iowa: Hancock County



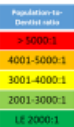
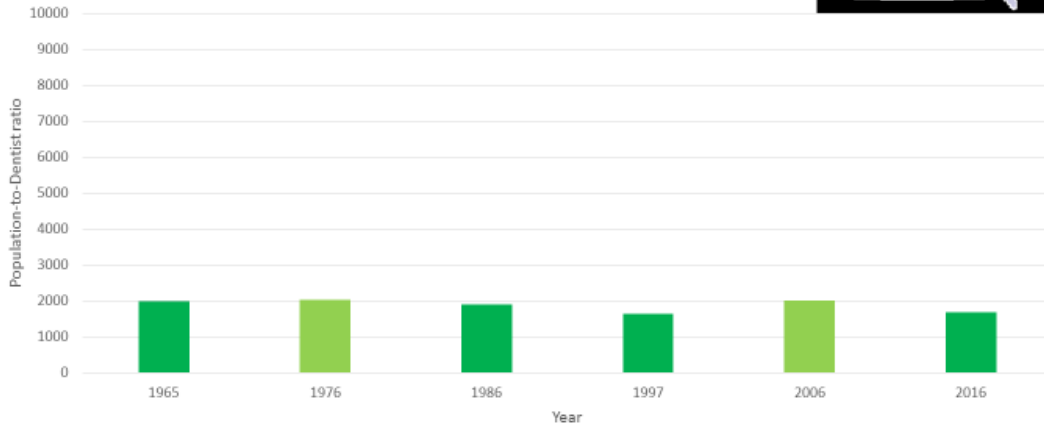
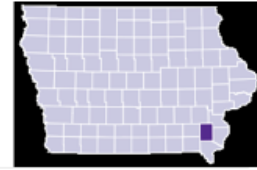
Population-to-Dentist Ratios, Iowa: Hardin County



Population-to-Dentist Ratios, Iowa: Harrison County



Population-to-Dentist Ratios, Iowa: Henry County

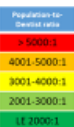
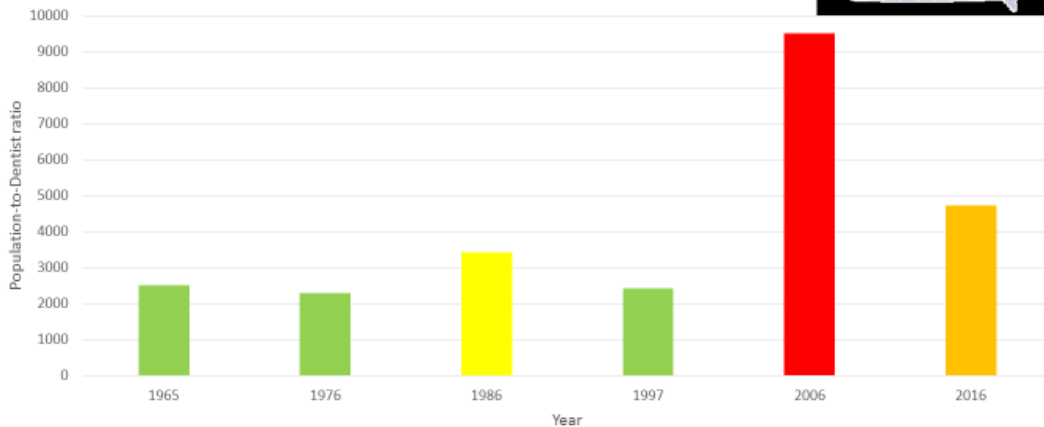
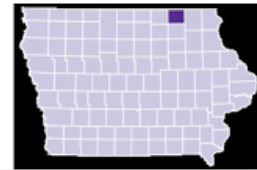


2013 RUCC category: 6

Typology (2015): Manufacturing

Pull Factor (2017): 0.81

Population-to-Dentist Ratios, Iowa: Howard County

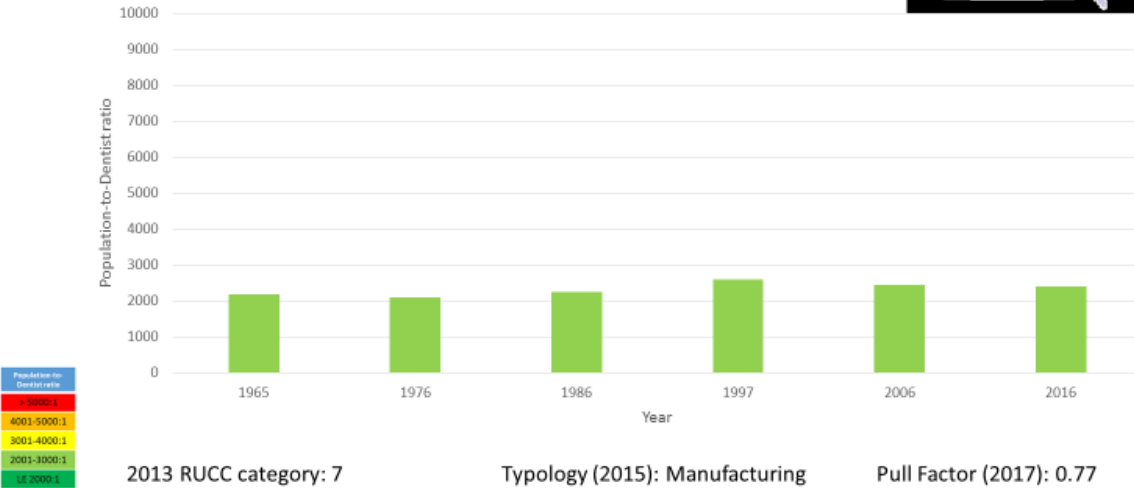
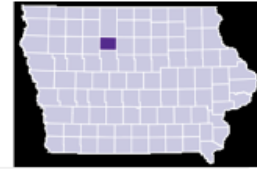


2013 RUCC category: 6

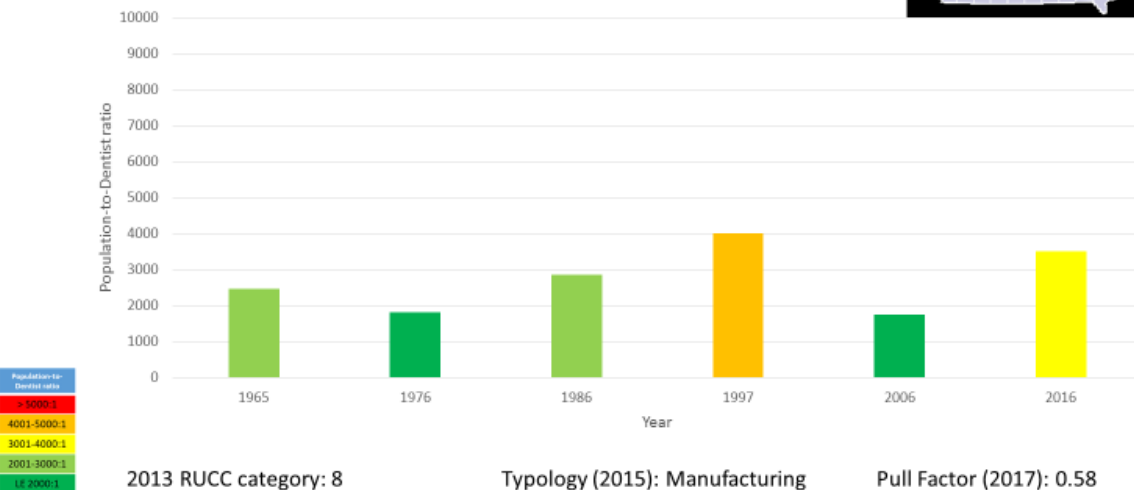
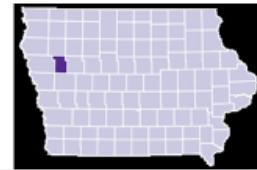
Typology (2015): Farming

Pull Factor (2017): 0.72

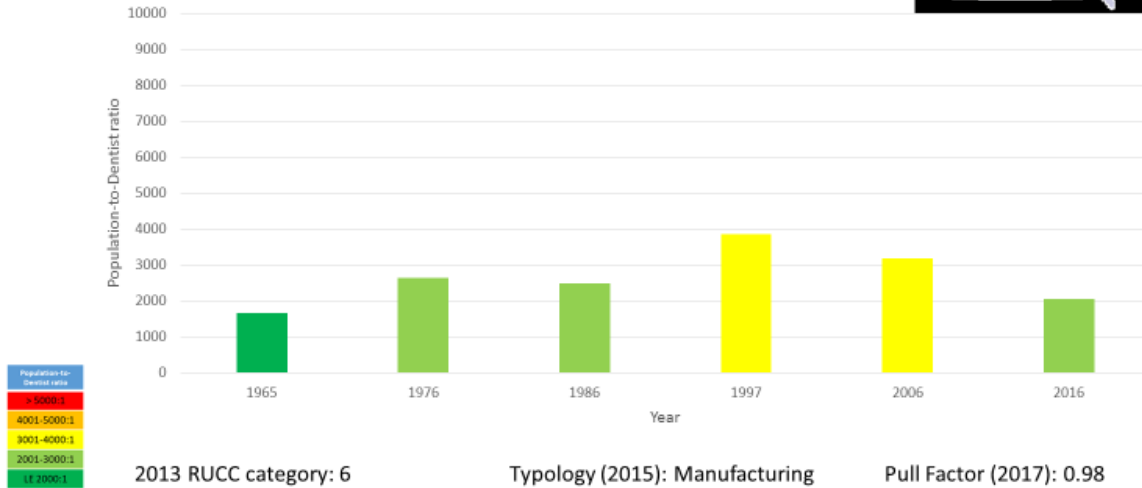
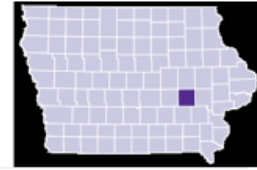
Population-to-Dentist Ratios, Iowa: Humboldt County



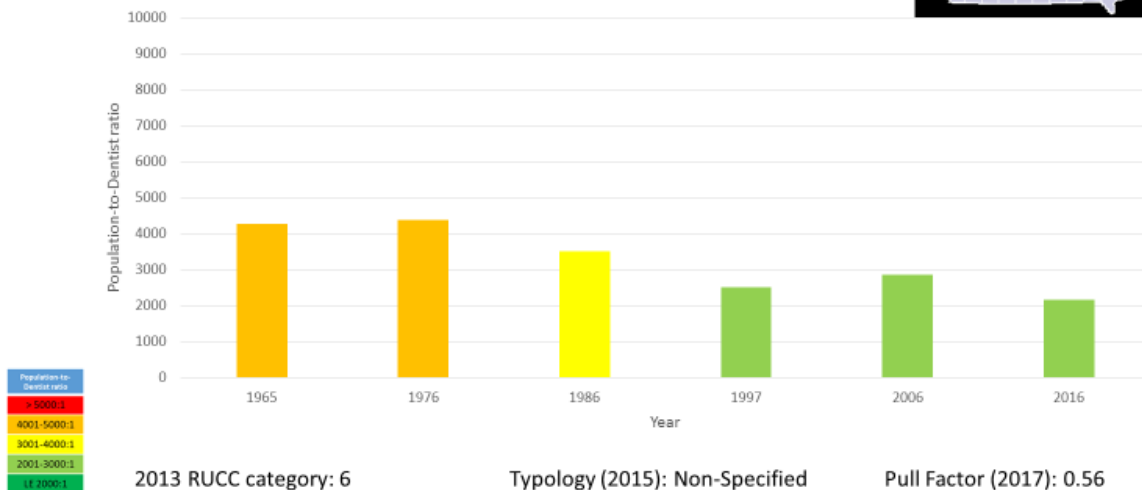
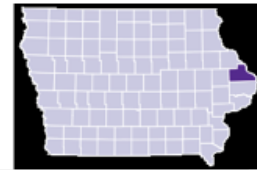
Population-to-Dentist Ratios, Iowa: Ida County



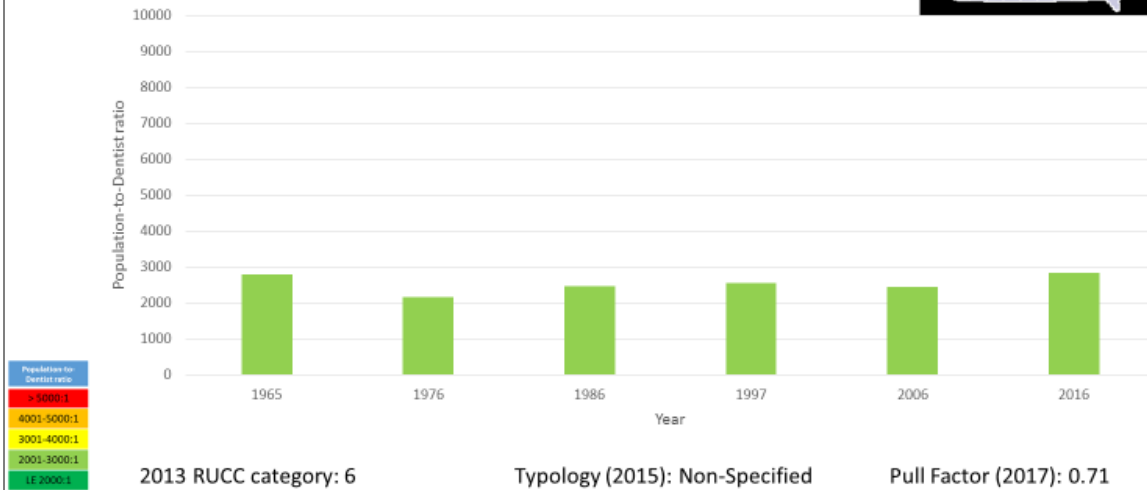
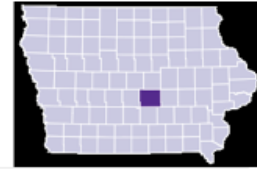
Population-to-Dentist Ratios, Iowa: Iowa County



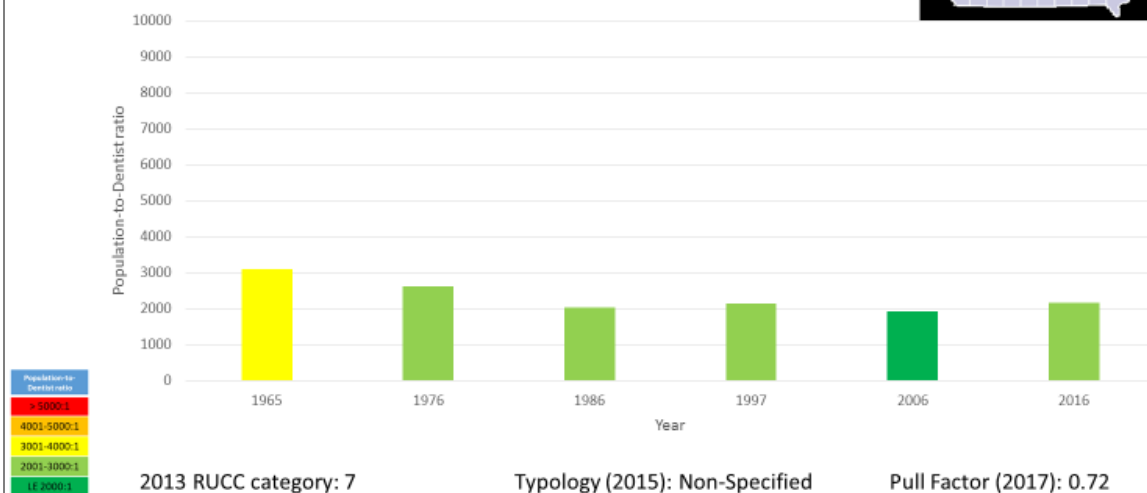
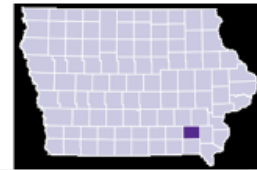
Population-to-Dentist Ratios, Iowa: Jackson County



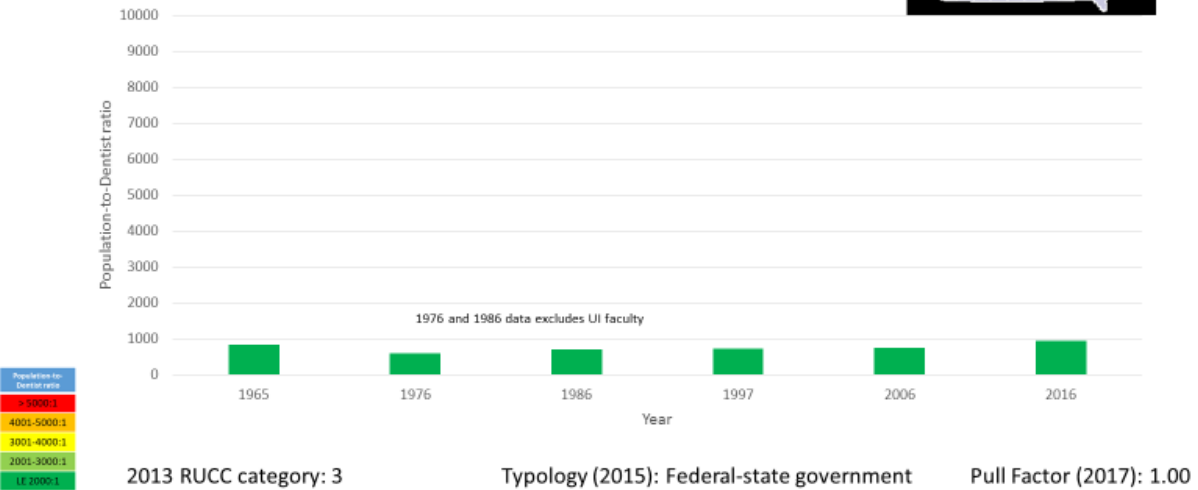
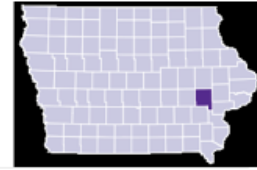
Population-to-Dentist Ratios, Iowa: Jasper County



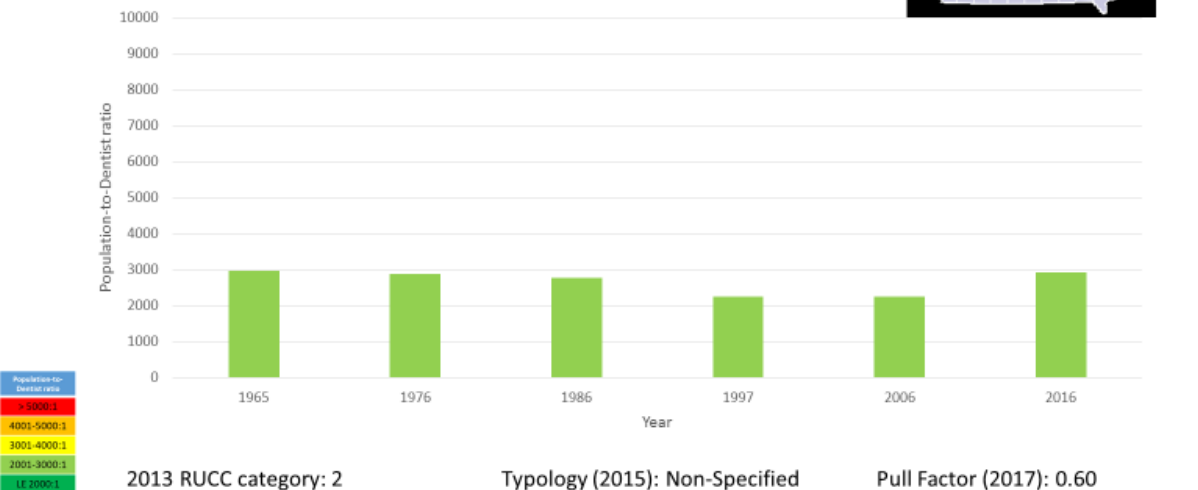
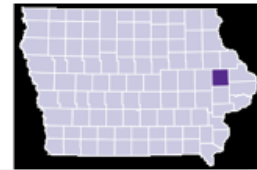
Population-to-Dentist Ratios, Iowa: Jefferson County



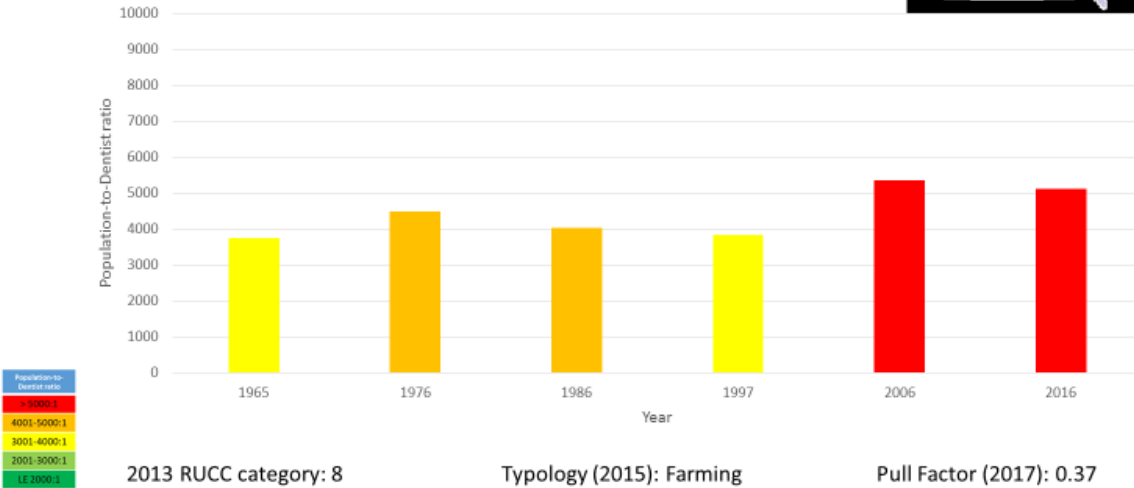
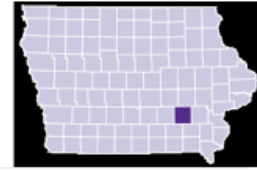
Population-to-Dentist Ratios, Iowa: Johnson County



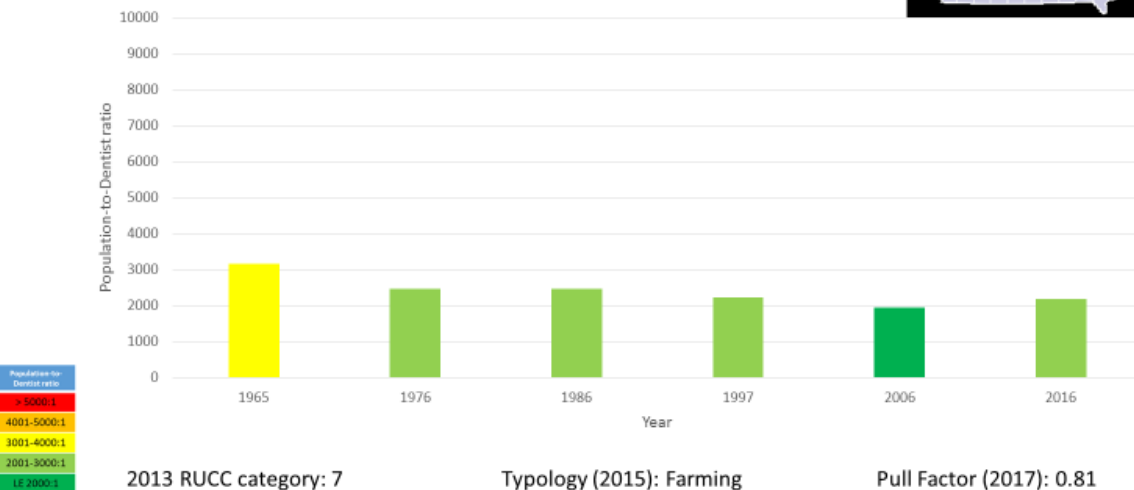
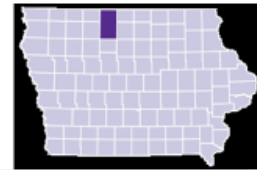
Population-to-Dentist Ratios, Iowa: Jones County



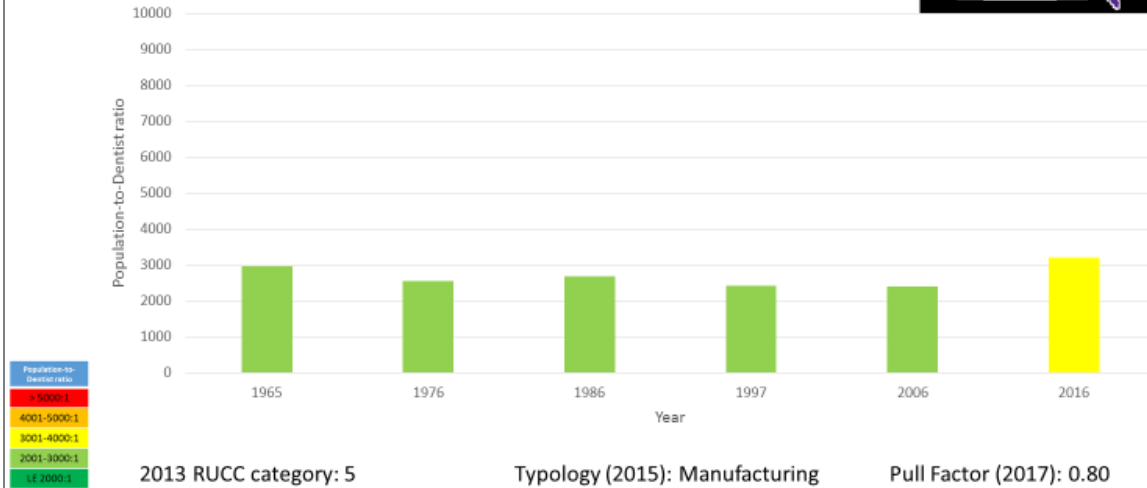
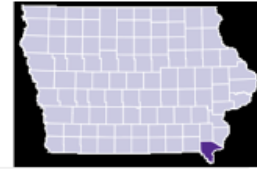
Population-to-Dentist Ratios, Iowa: Keokuk County



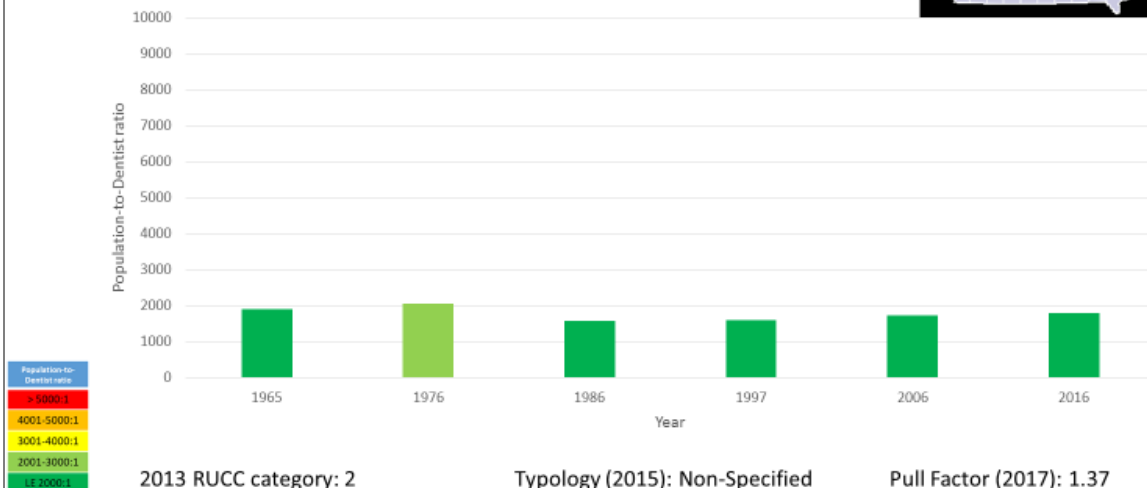
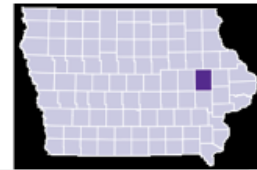
Population-to-Dentist Ratios, Iowa: Kossuth County



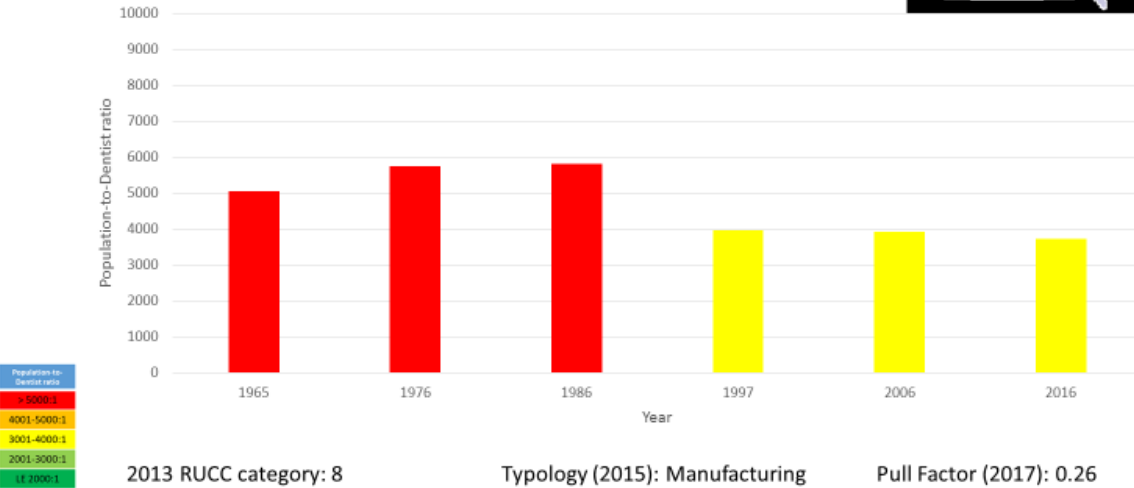
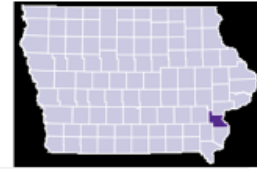
Population-to-Dentist Ratios, Iowa: Lee County



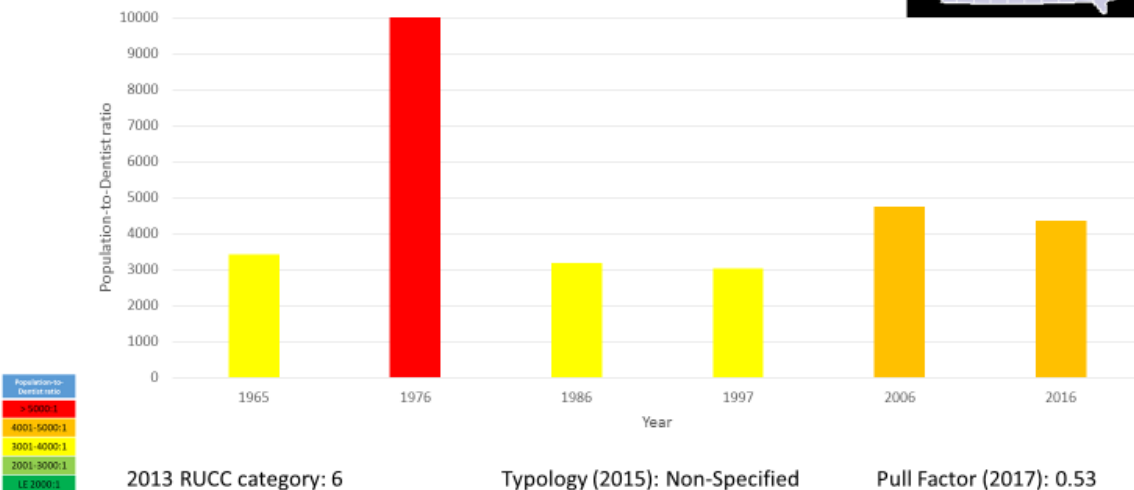
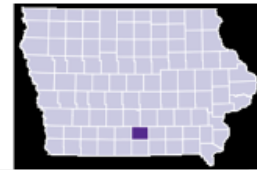
Population-to-Dentist Ratios, Iowa: Linn County



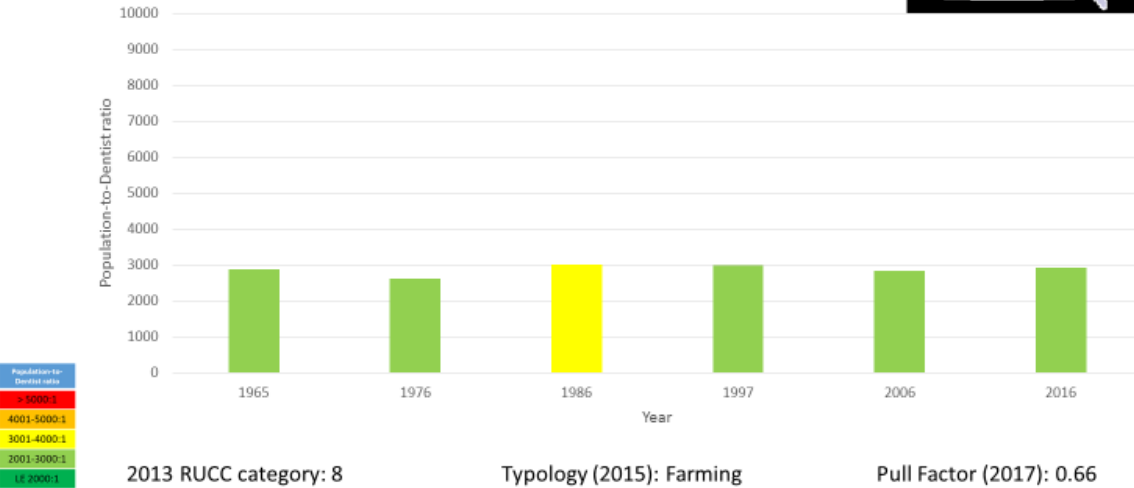
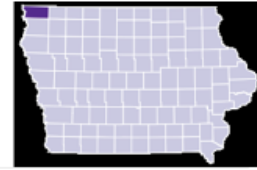
Population-to-Dentist Ratios, Iowa: Louisa County



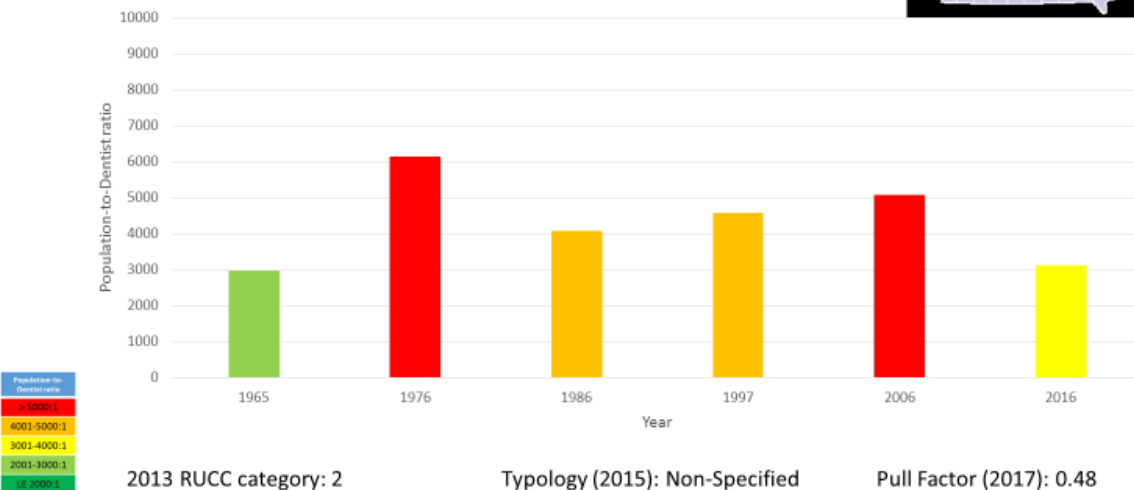
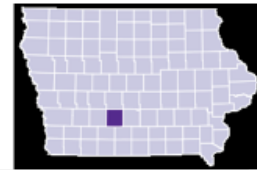
Population-to-Dentist Ratios, Iowa: Lucas County



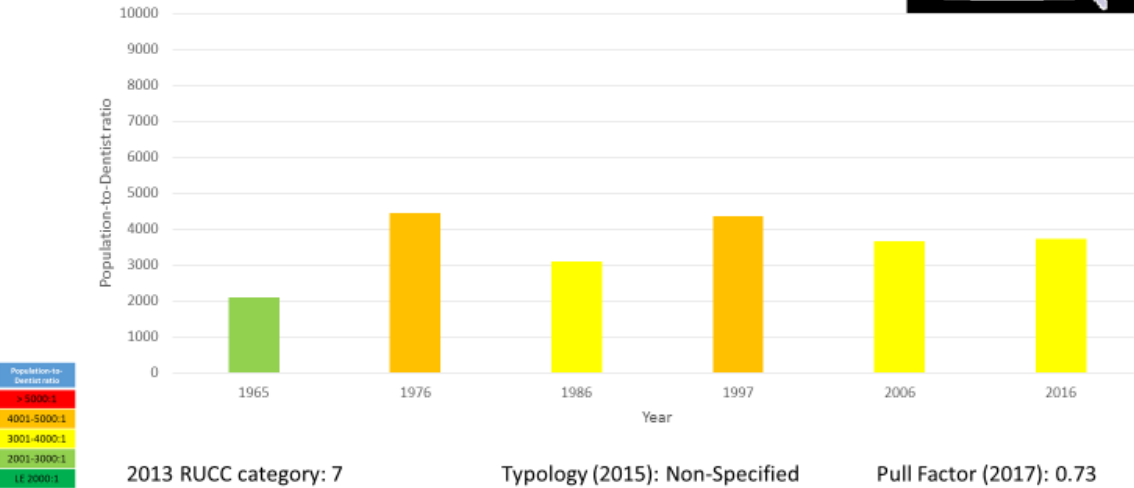
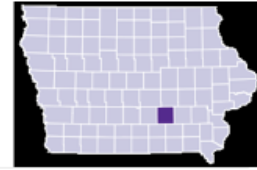
Population-to-Dentist Ratios, Iowa: Lyon County



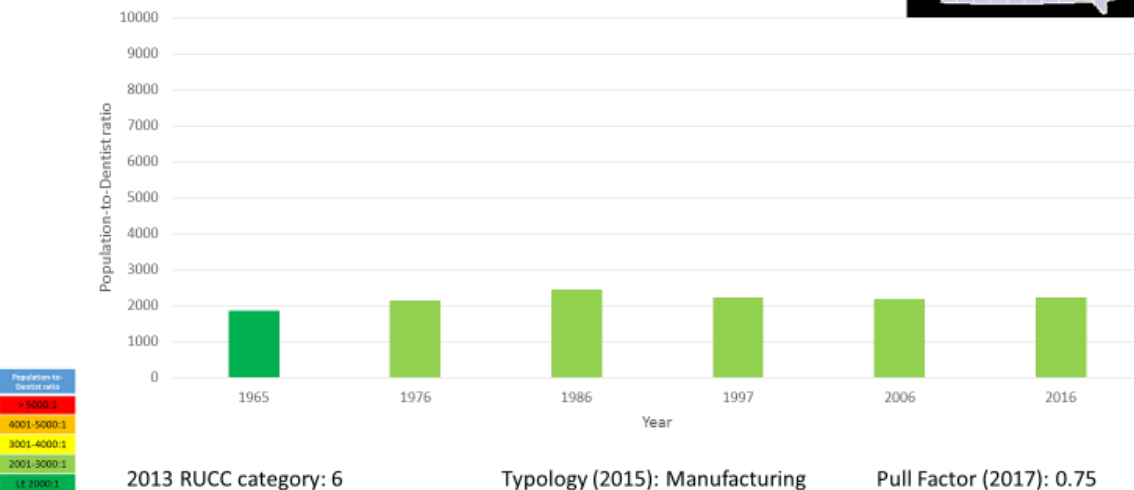
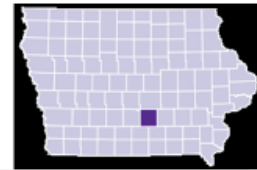
Population-to-Dentist Ratios, Iowa: Madison County



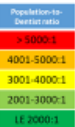
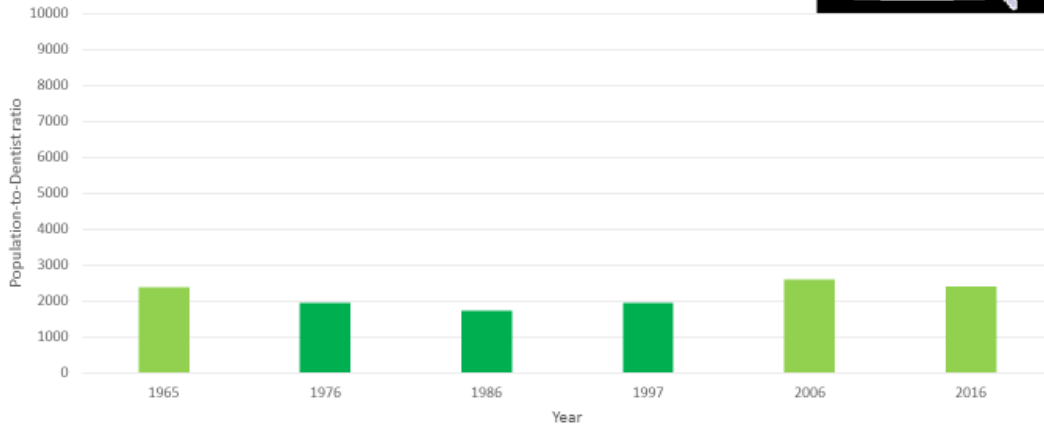
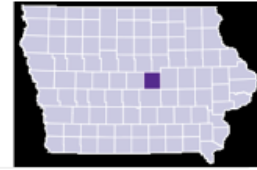
Population-to-Dentist Ratios, Iowa: Mahaska County



Population-to-Dentist Ratios, Iowa: Marion County



Population-to-Dentist Ratios, Iowa: Marshall County

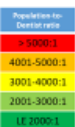
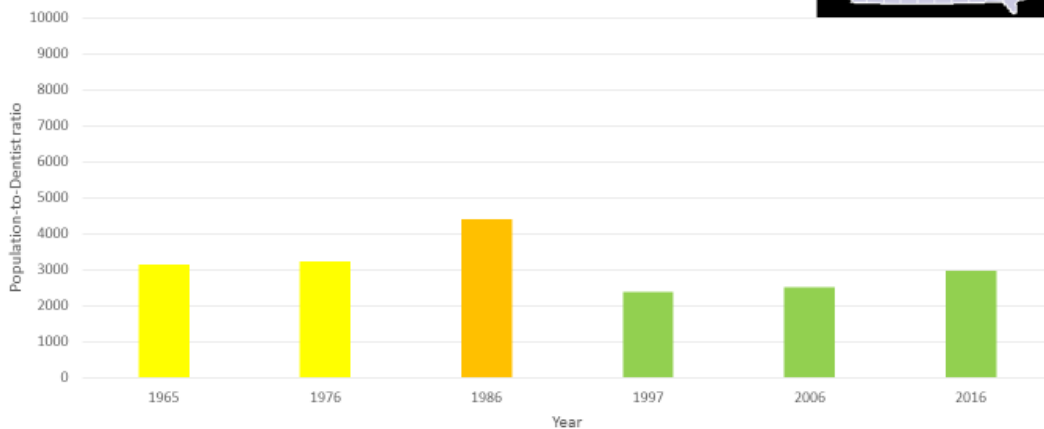
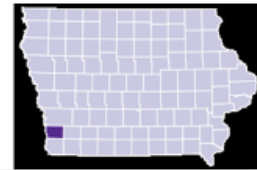


2013 RUCC category: 4

Typology (2015): Manufacturing

Pull Factor (2017): 0.82

Population-to-Dentist Ratios, Iowa: Mills County

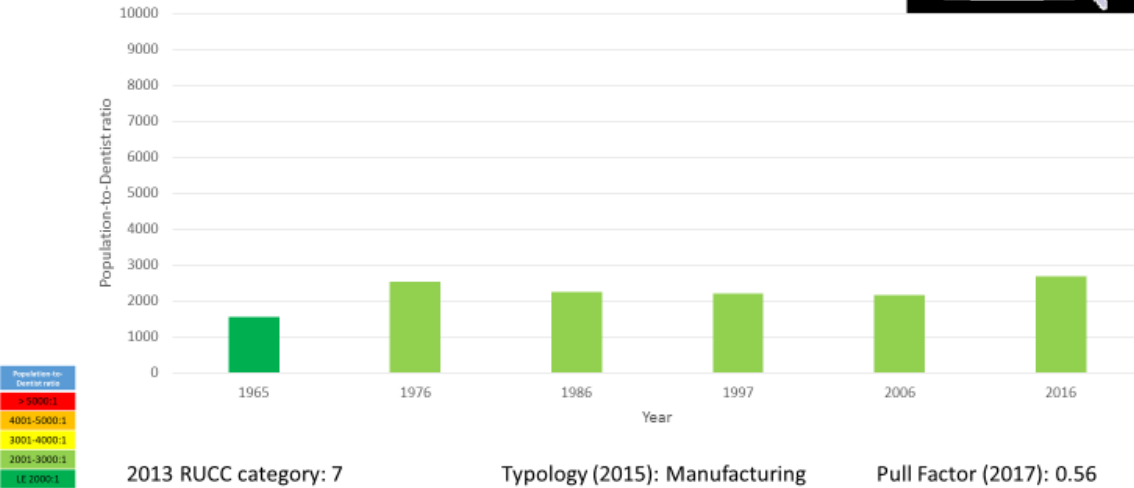
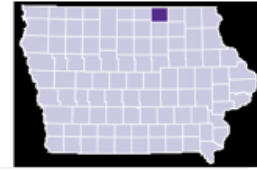


2013 RUCC category: 2

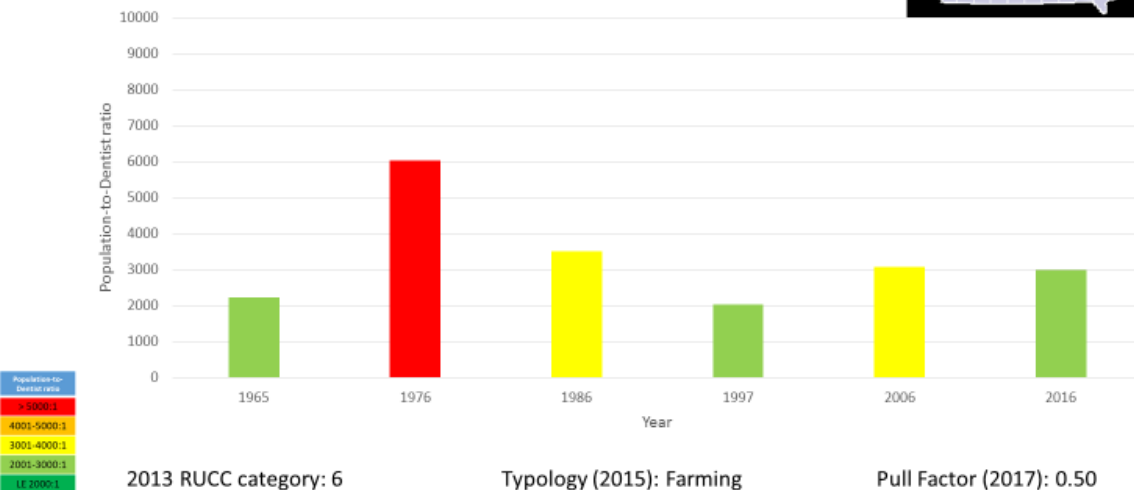
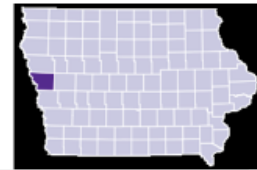
Typology (2015): Federal-state government

Pull Factor (2017): 0.42

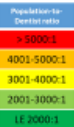
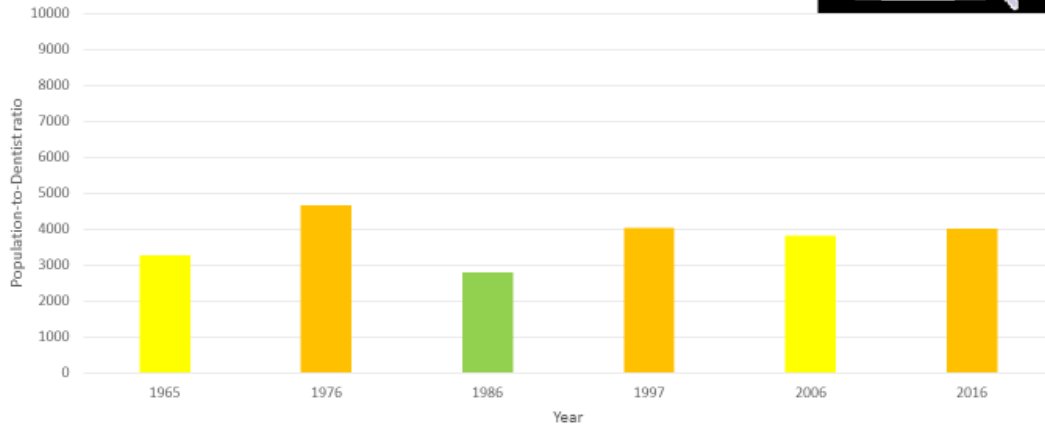
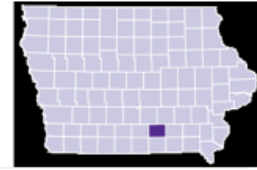
Population-to-Dentist Ratios, Iowa: Mitchell County



Population-to-Dentist Ratios, Iowa: Monona County



Population-to-Dentist Ratios, Iowa: Monroe County

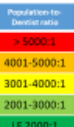
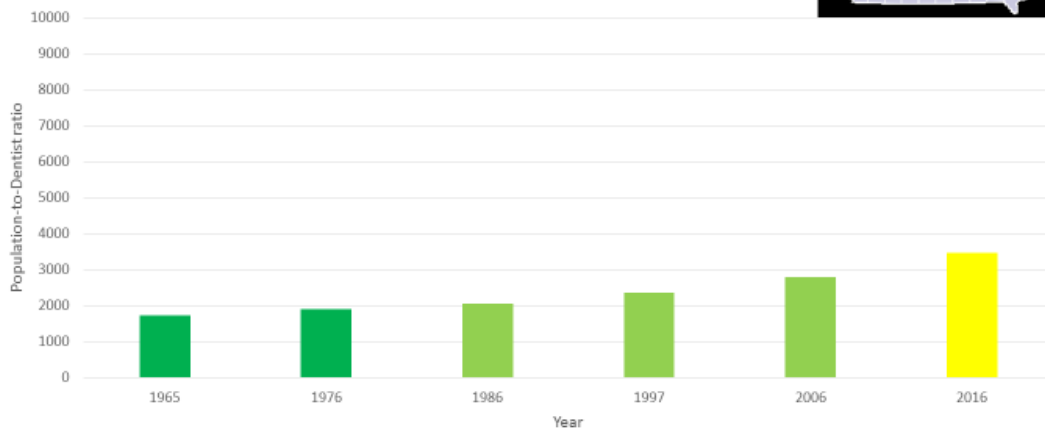
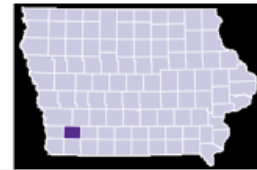


2013 RUCC category: 7

Typology (2015): Manufacturing

Pull Factor (2017): 0.47

Population-to-Dentist Ratios, Iowa: Montgomery County

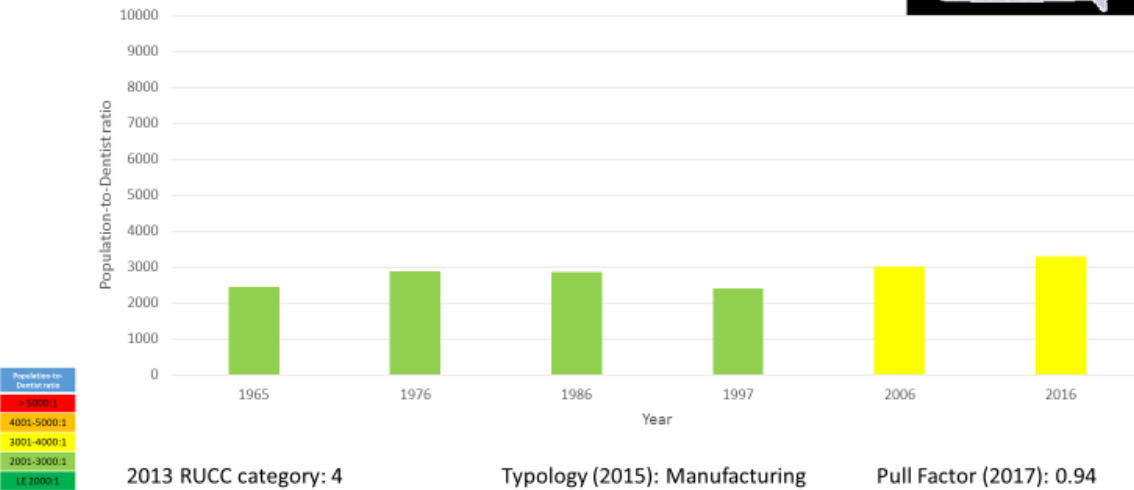
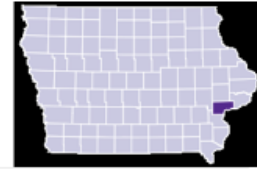


2013 RUCC category: 6

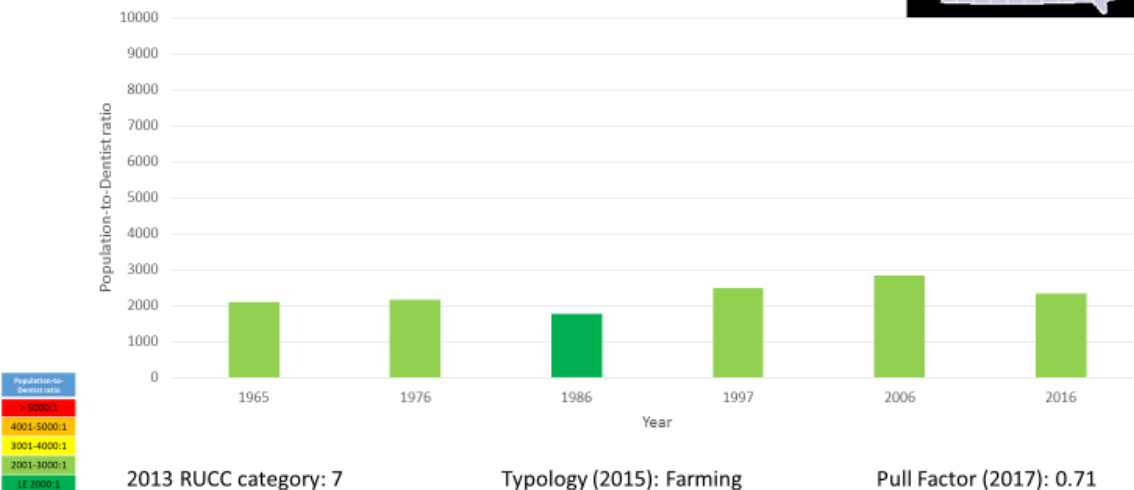
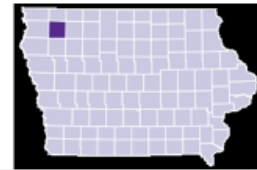
Typology (2015): Non-Specified

Pull Factor (2017): 0.65

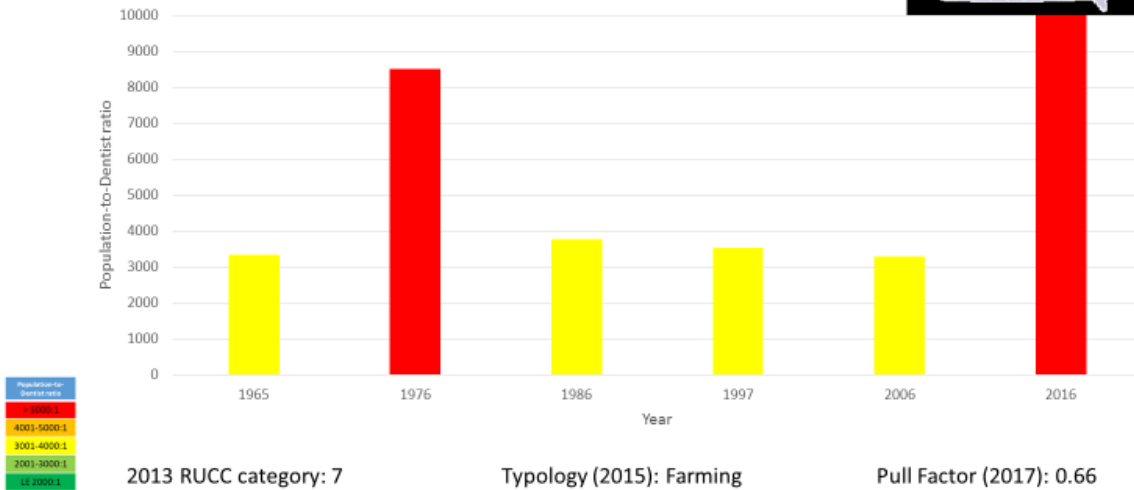
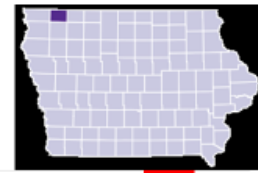
Population-to-Dentist Ratios, Iowa: Muscatine County



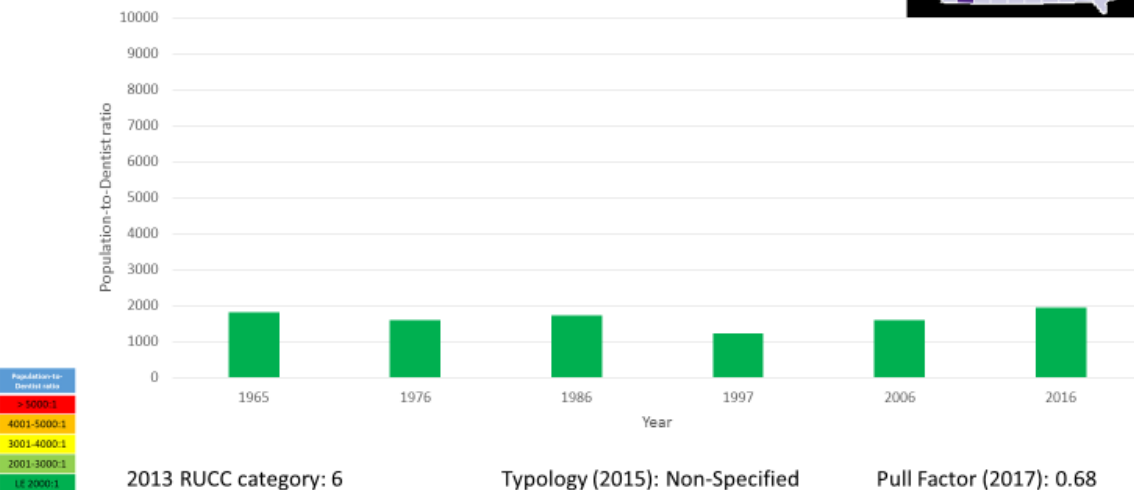
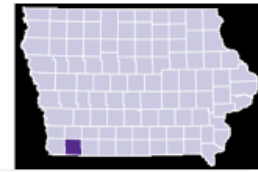
Population-to-Dentist Ratios, Iowa: O'Brien County



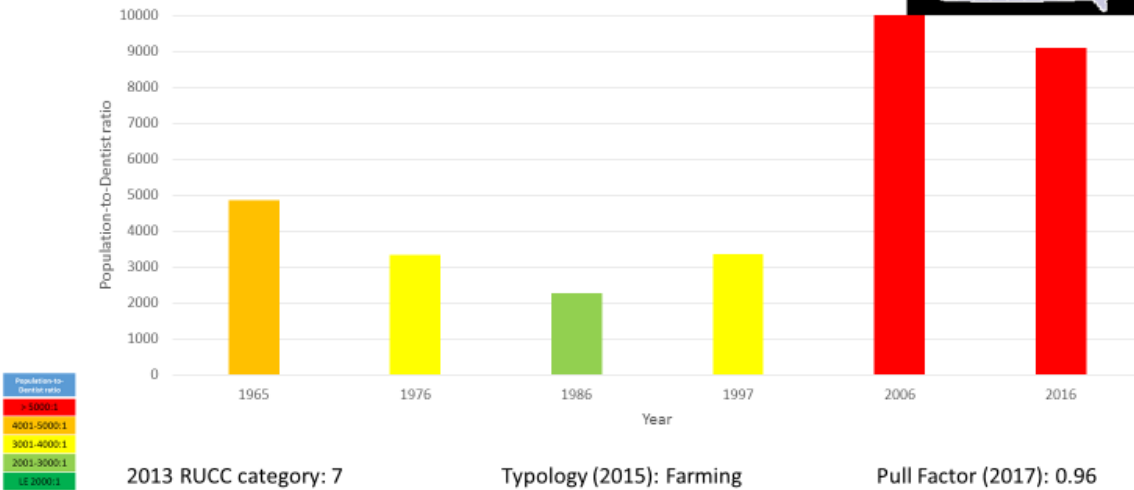
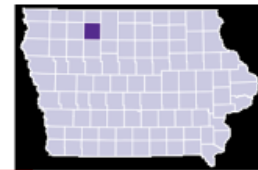
Population-to-Dentist Ratios, Iowa: Osceola County



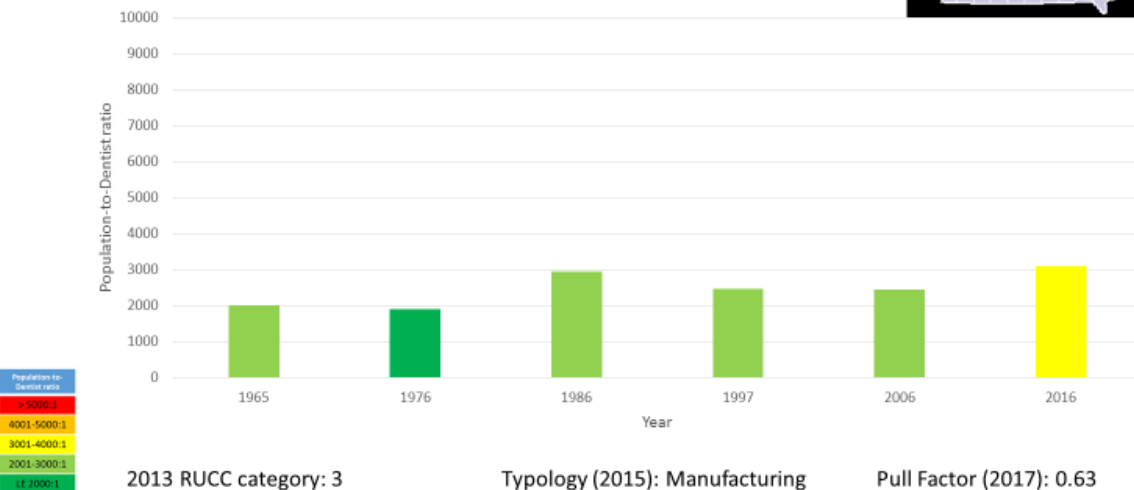
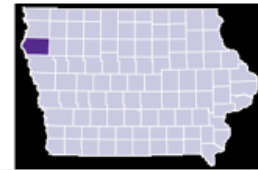
Population-to-Dentist Ratios, Iowa: Page County



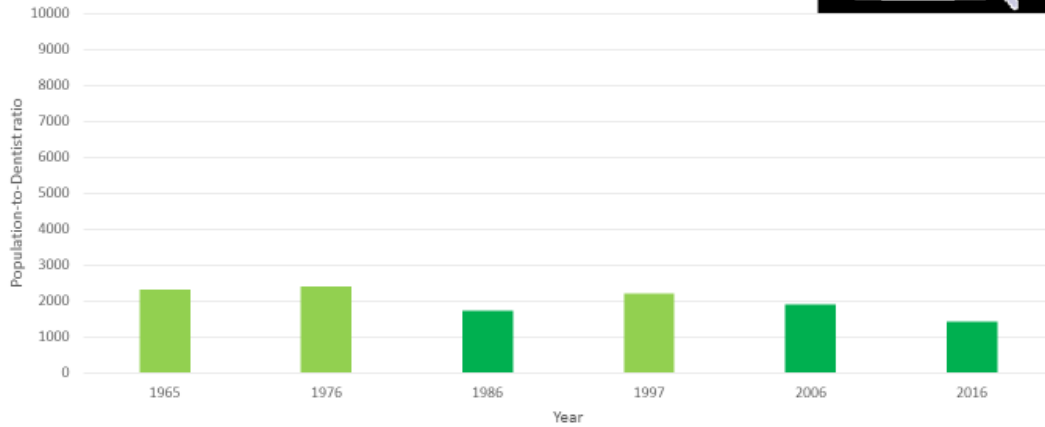
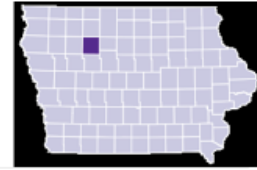
Population-to-Dentist Ratios, Iowa: Palo Alto County



Population-to-Dentist Ratios, Iowa: Plymouth County



Population-to-Dentist Ratios, Iowa: Pocahontas County

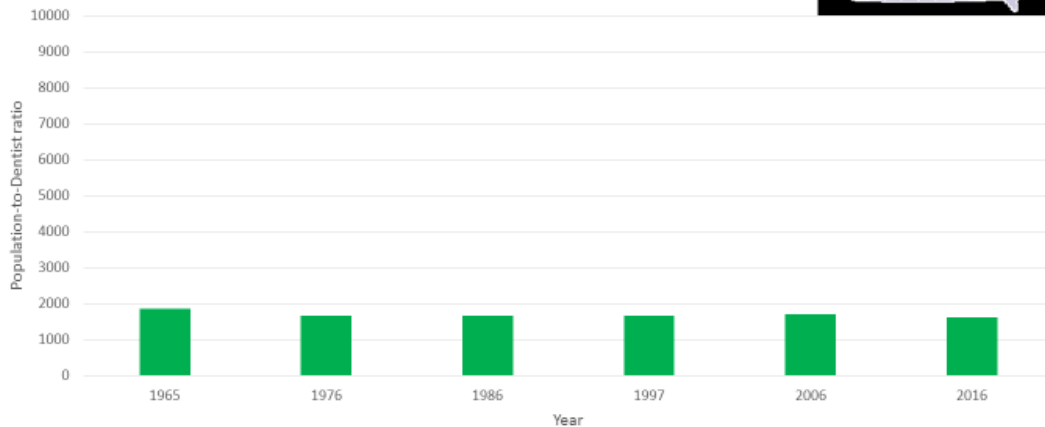
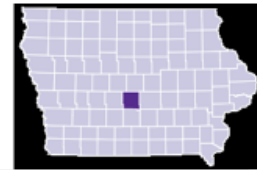


2013 RUCC category: 9

Typology (2015): Farming

Pull Factor (2017): 0.49

Population-to-Dentist Ratios, Iowa: Polk County

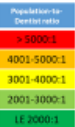
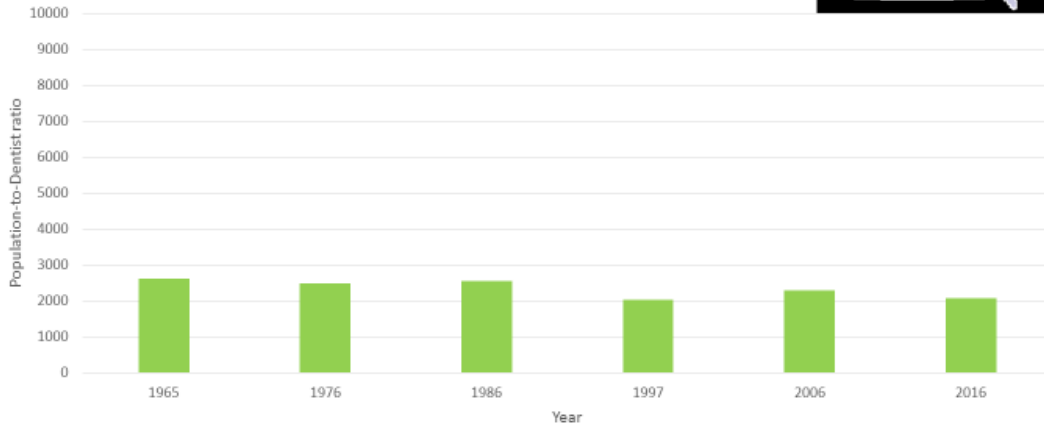
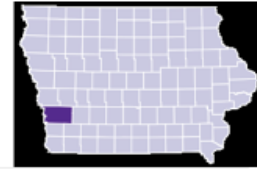


2013 RUCC category: 2

Typology (2015): Non-Specified

Pull Factor (2017): 1.35

Population-to-Dentist Ratios, Iowa: Pottawattamie County

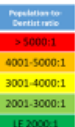
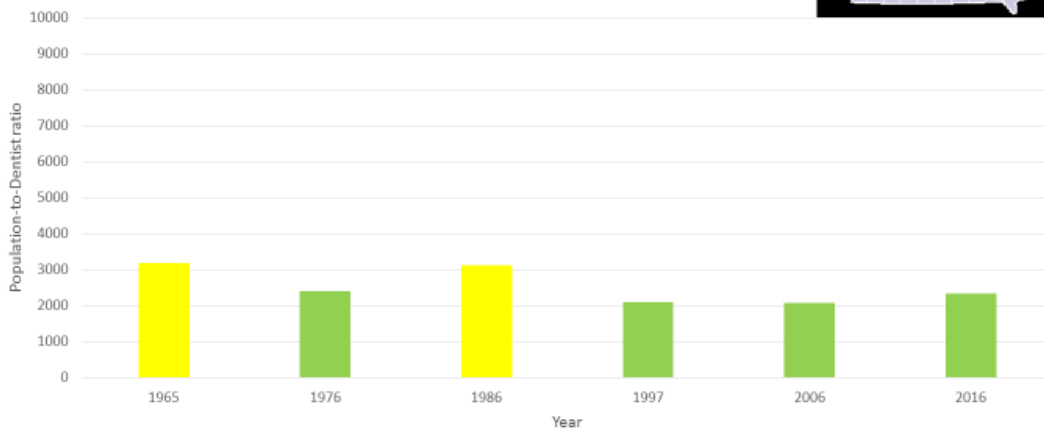
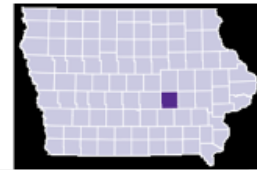


2013 RUCC category: 2

Typology (2015): Non-Specified

Pull Factor (2017): 1.04

Population-to-Dentist Ratios, Iowa: Poweshiek County

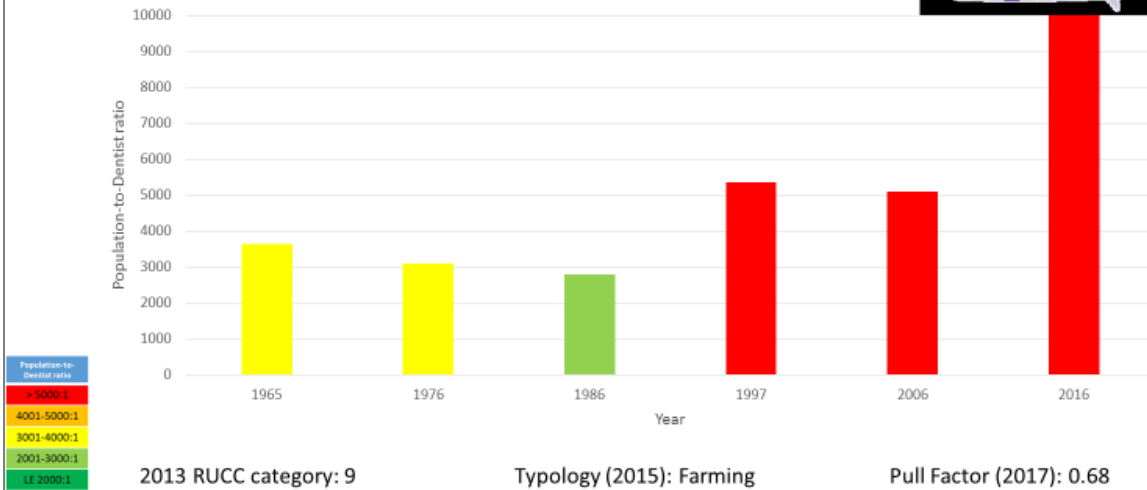
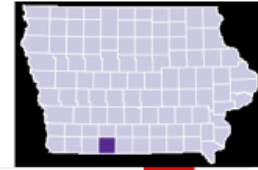


2013 RUCC category: 7

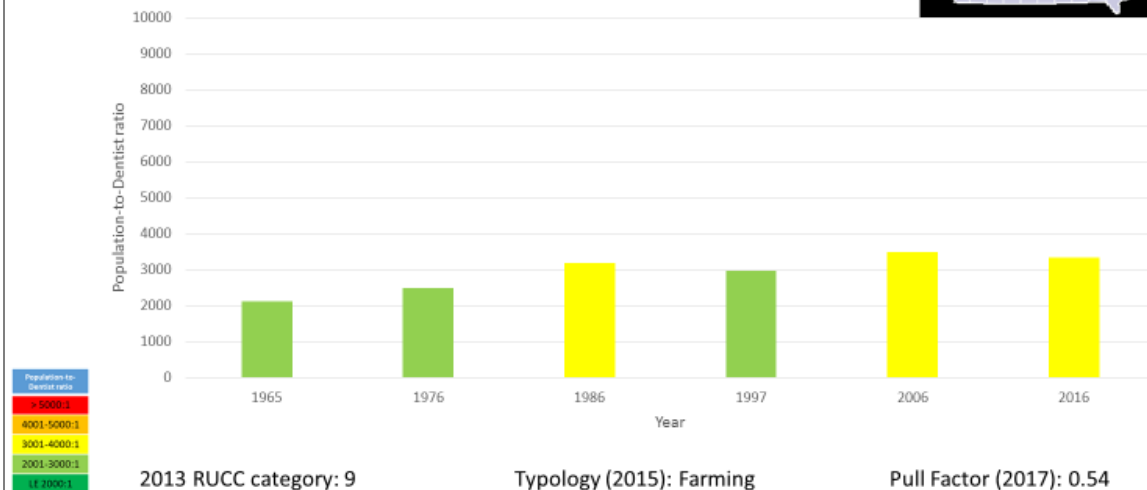
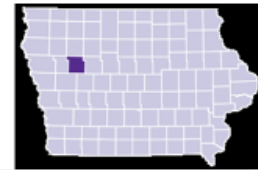
Typology (2015): Non-Specified

Pull Factor (2017): 0.77

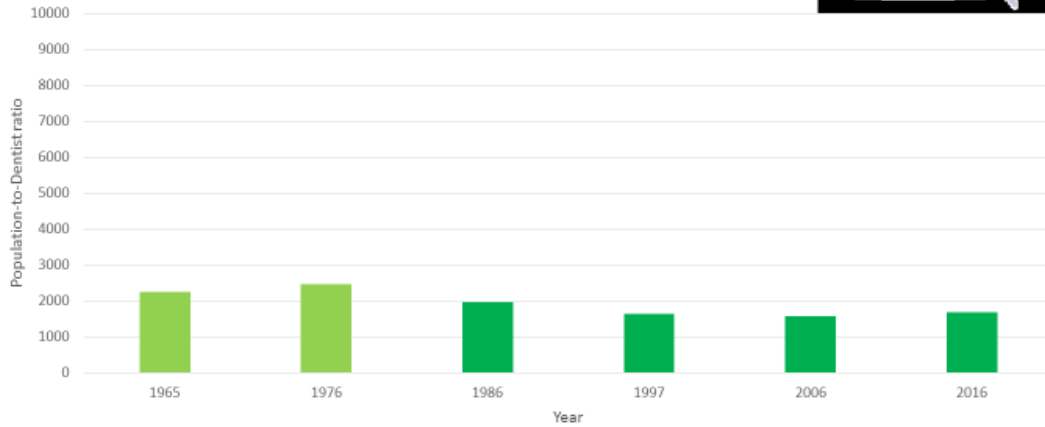
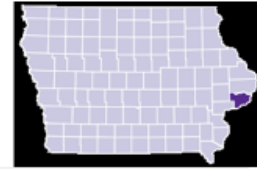
Population-to-Dentist Ratios, Iowa: Ringgold County



Population-to-Dentist Ratios, Iowa: Sac County



Population-to-Dentist Ratios, Iowa: Scott County

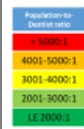
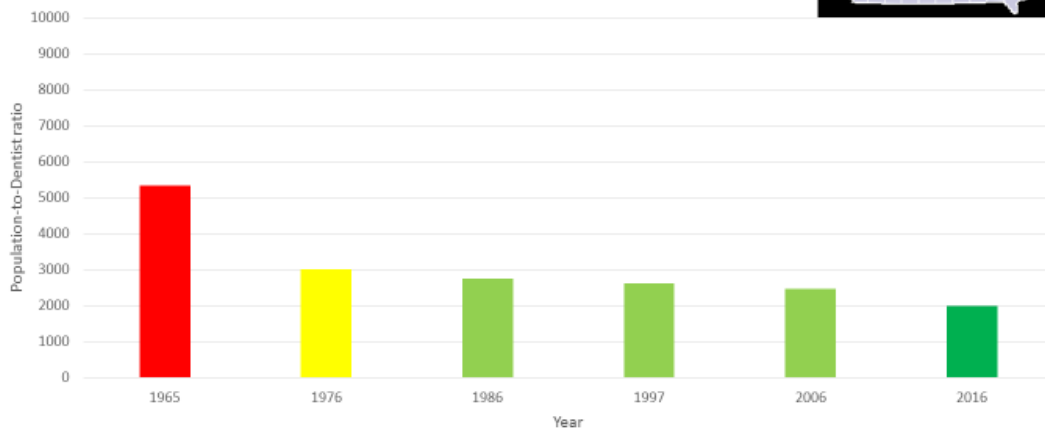
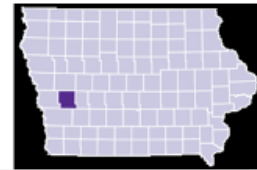


2013 RUCC category: 2

Typology (2015): Non-Specified

Pull Factor (2017): 1.24

Population-to-Dentist Ratios, Iowa: Shelby County

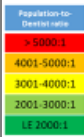
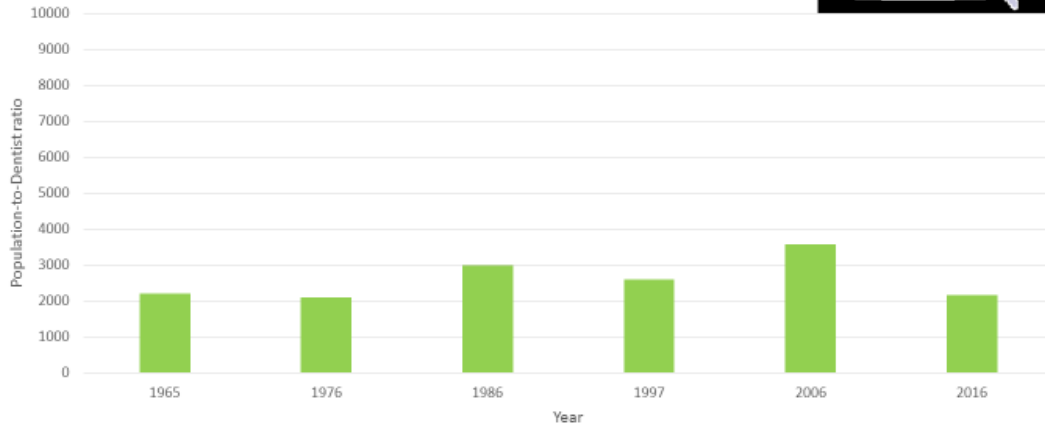
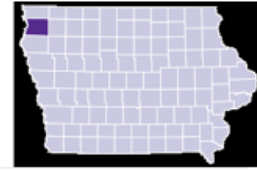


2013 RUCC category: 6

Typology (2015): Non-Specified

Pull Factor (2017): 0.59

Population-to-Dentist Ratios, Iowa: Sioux County

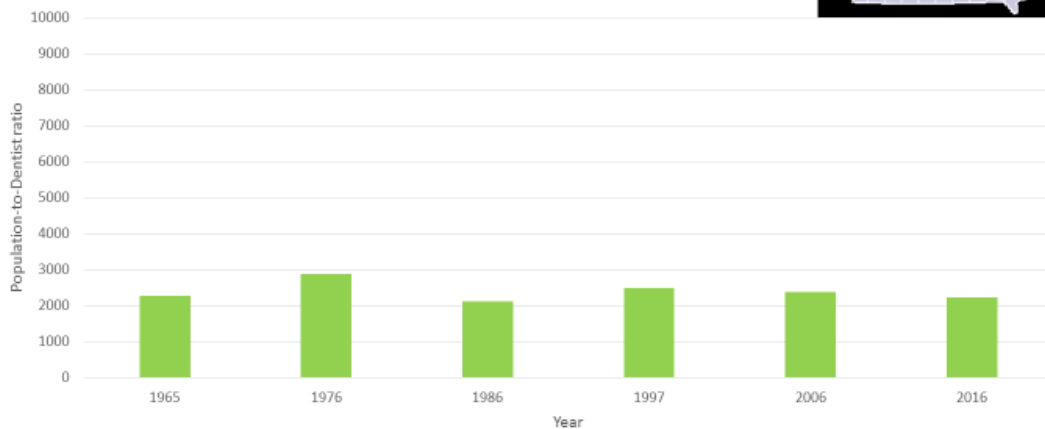
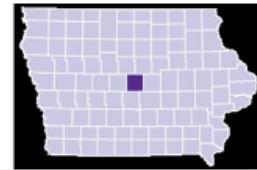


2013 RUCC category: 7

Typology (2015): Manufacturing

Pull Factor (2017): 0.91

Population-to-Dentist Ratios, Iowa: Story County

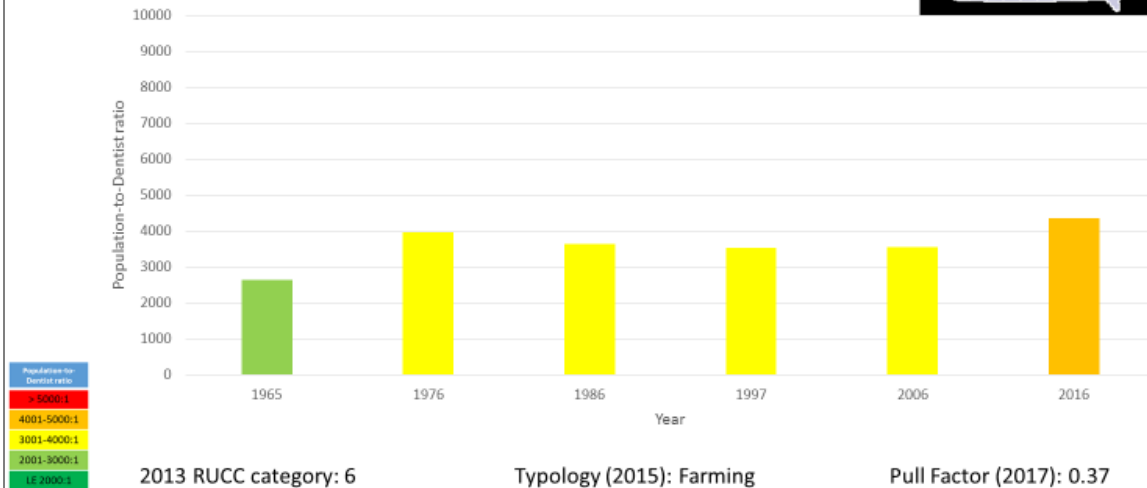
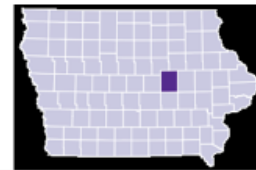


2013 RUCC category: 3

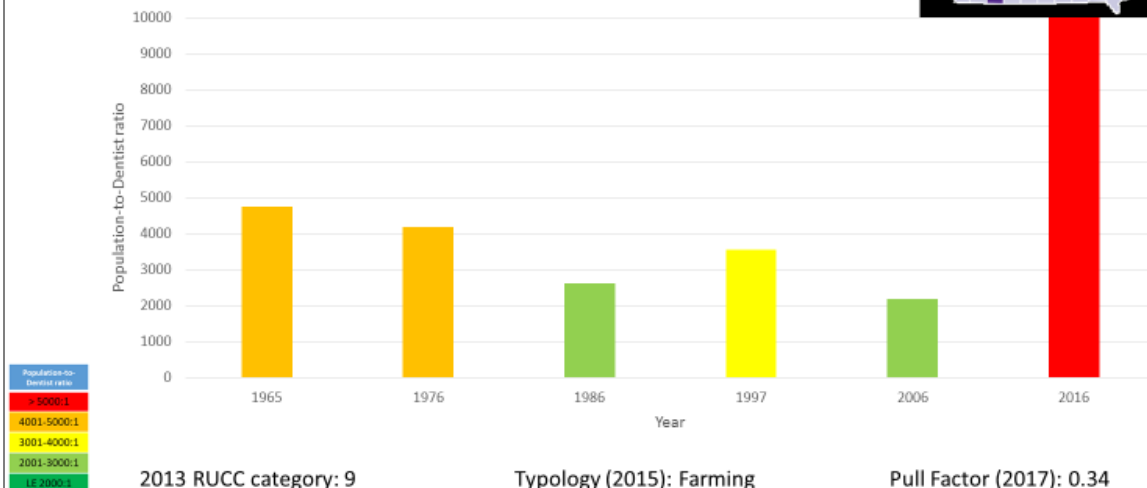
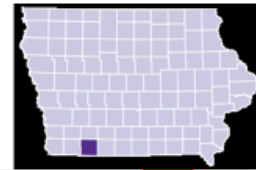
Typology (2015): Federal-state government

Pull Factor (2017): 0.92

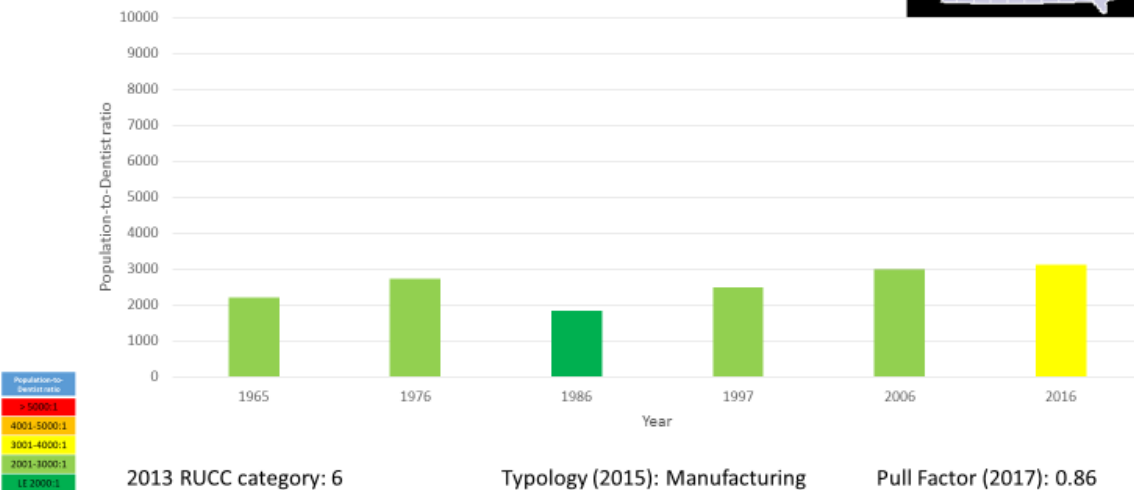
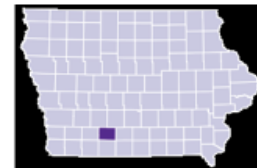
Population-to-Dentist Ratios, Iowa: Tama County



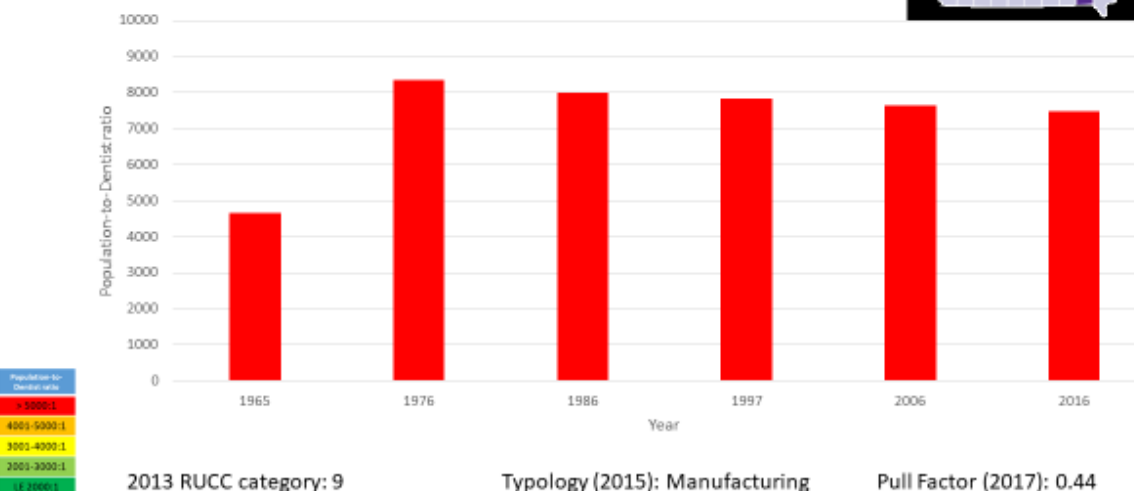
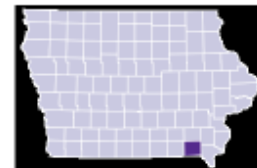
Population-to-Dentist Ratios, Iowa: Taylor County



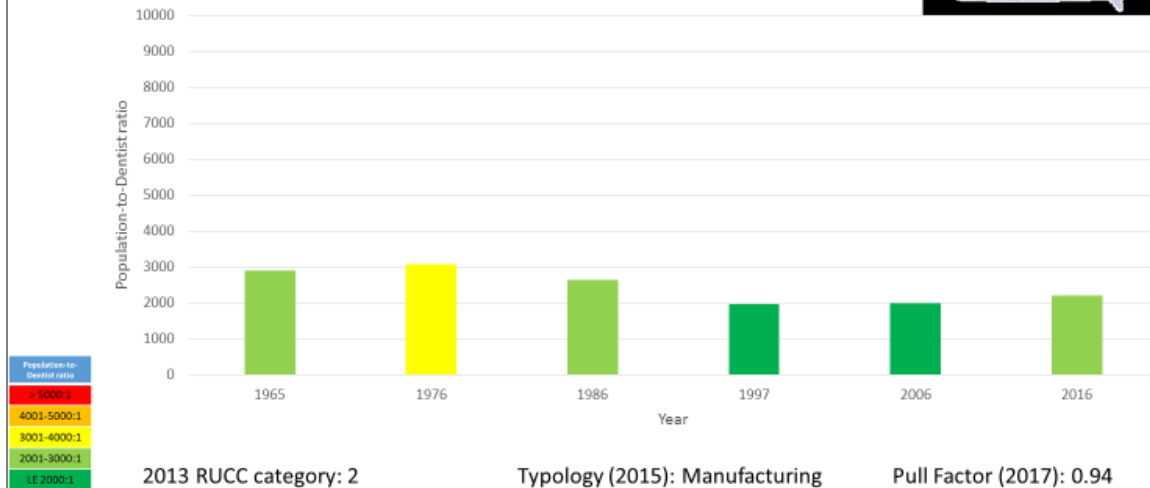
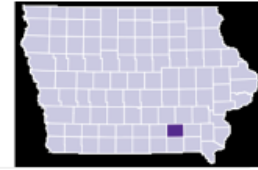
Population-to-Dentist Ratios, Iowa: Union County



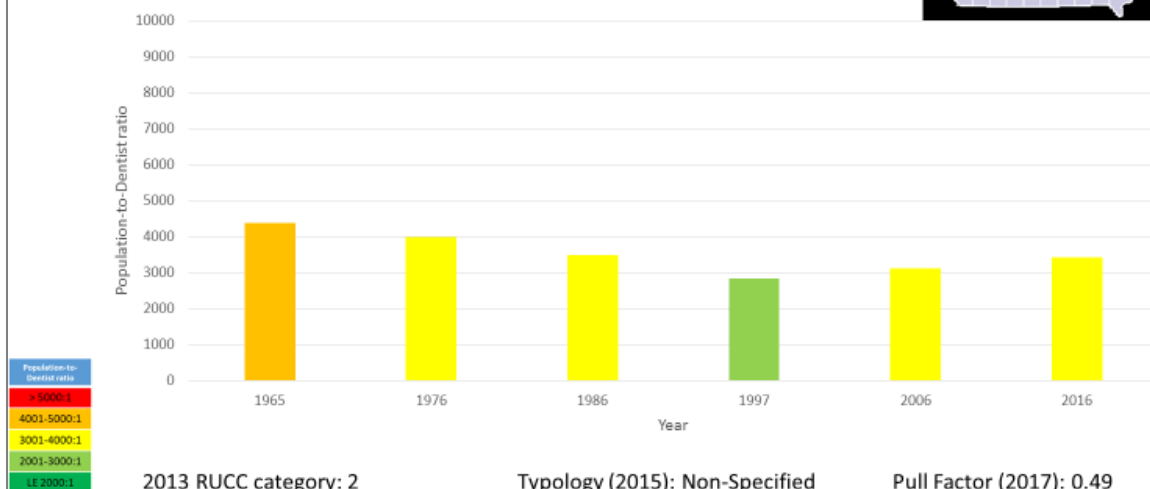
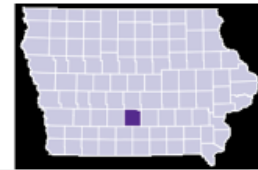
Population-to-Dentist Ratios, Iowa: Van Buren County



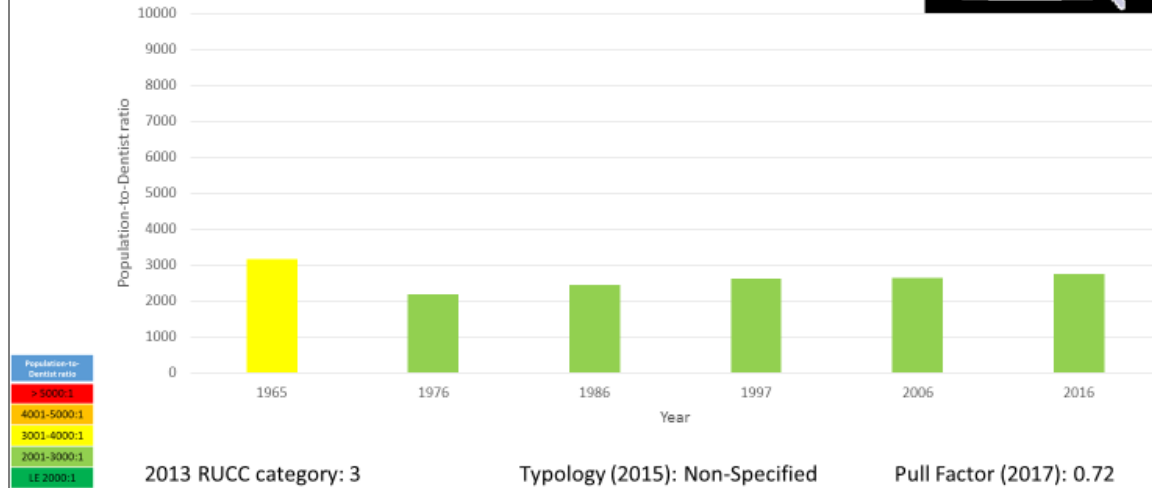
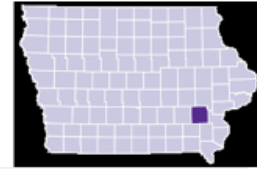
Population-to-Dentist Ratios, Iowa: Wapello County



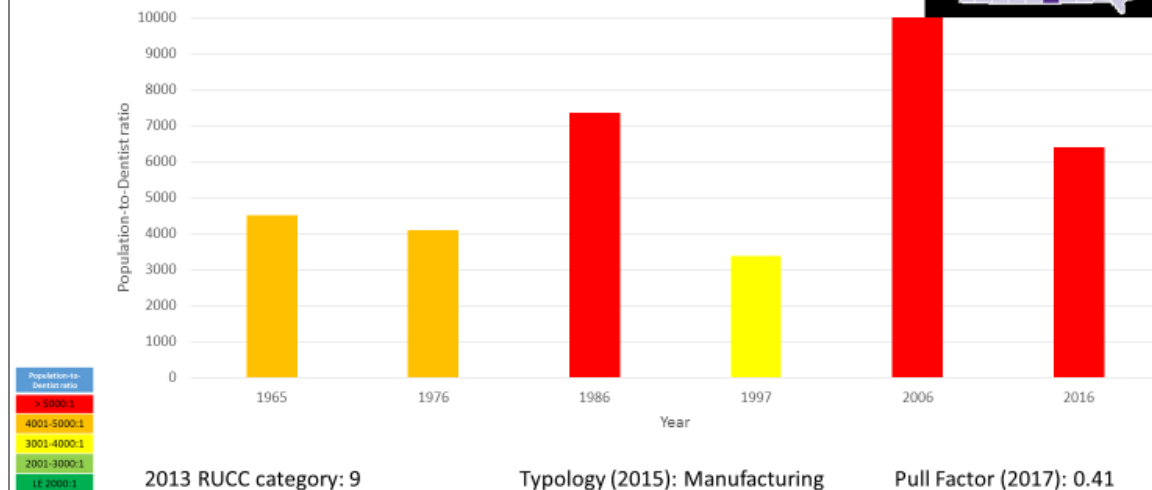
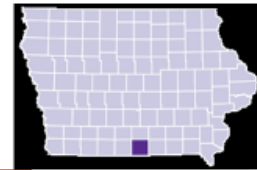
Population-to-Dentist Ratios, Iowa: Warren County



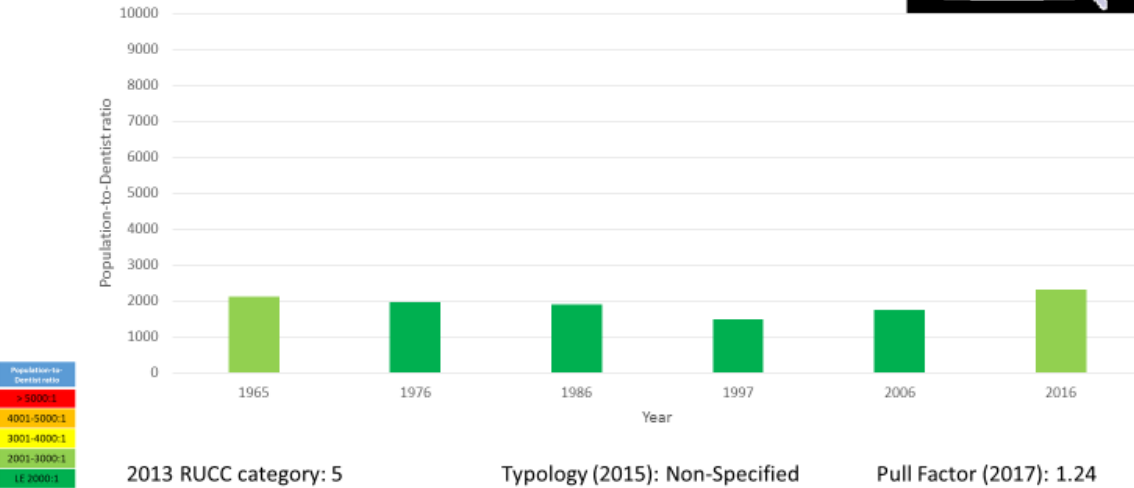
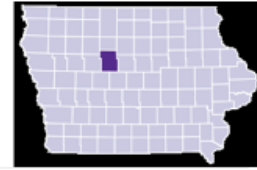
Population-to-Dentist Ratios, Iowa: Washington County



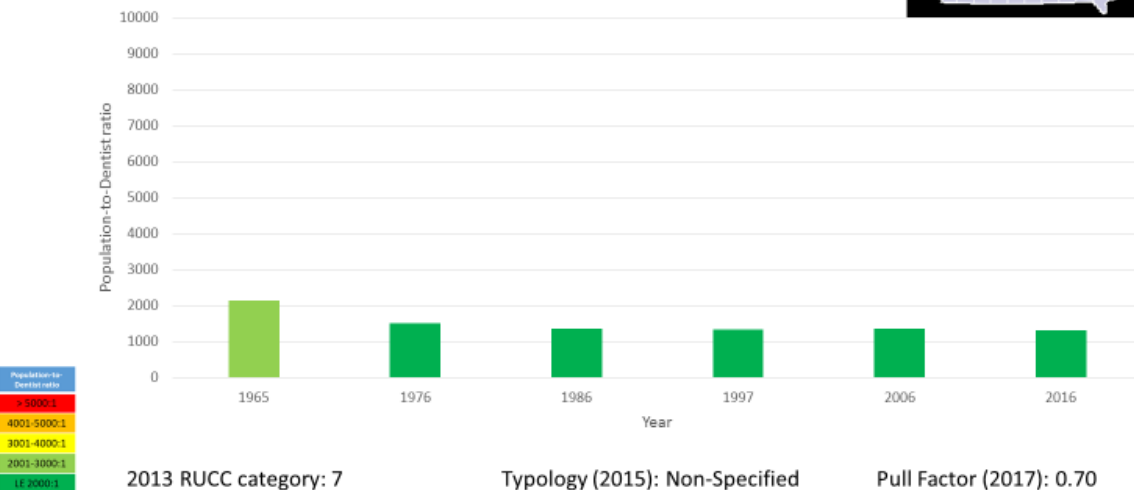
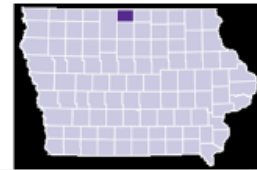
Population-to-Dentist Ratios, Iowa: Wayne County



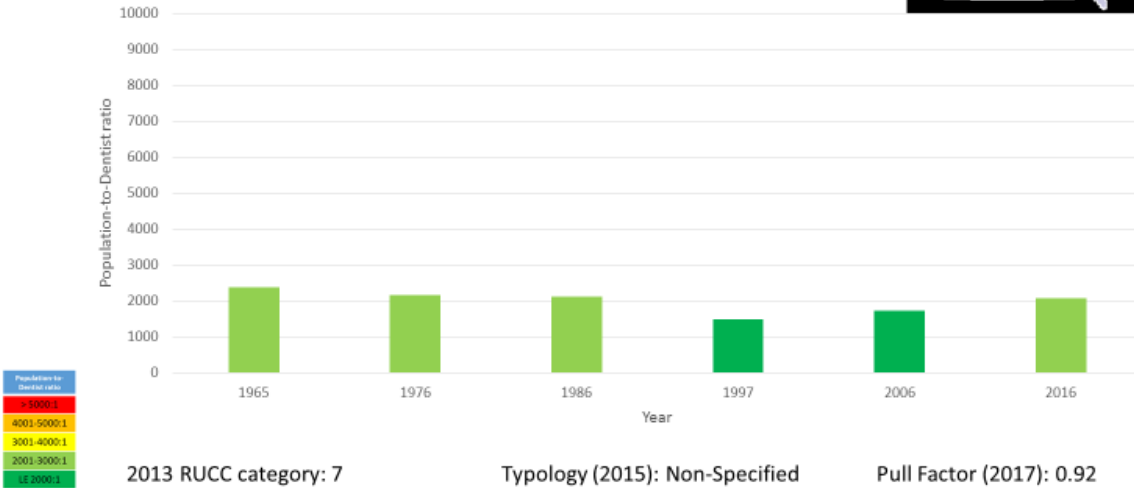
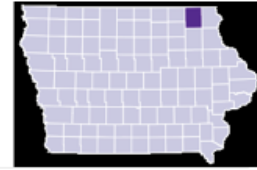
Population-to-Dentist Ratios, Iowa: Webster County



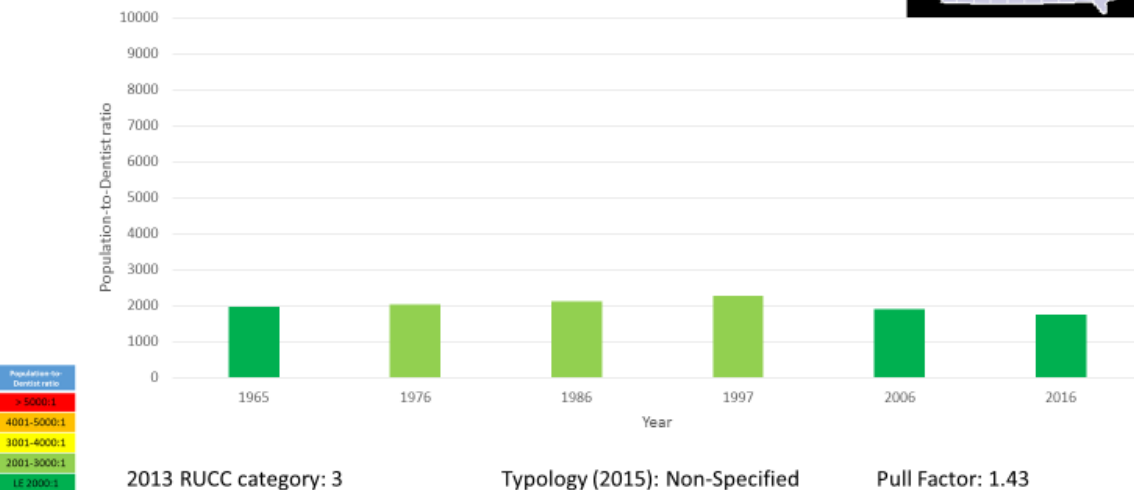
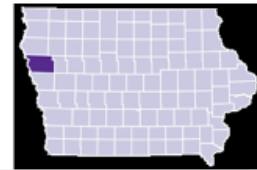
Population-to-Dentist Ratios, Iowa: Winnebago County



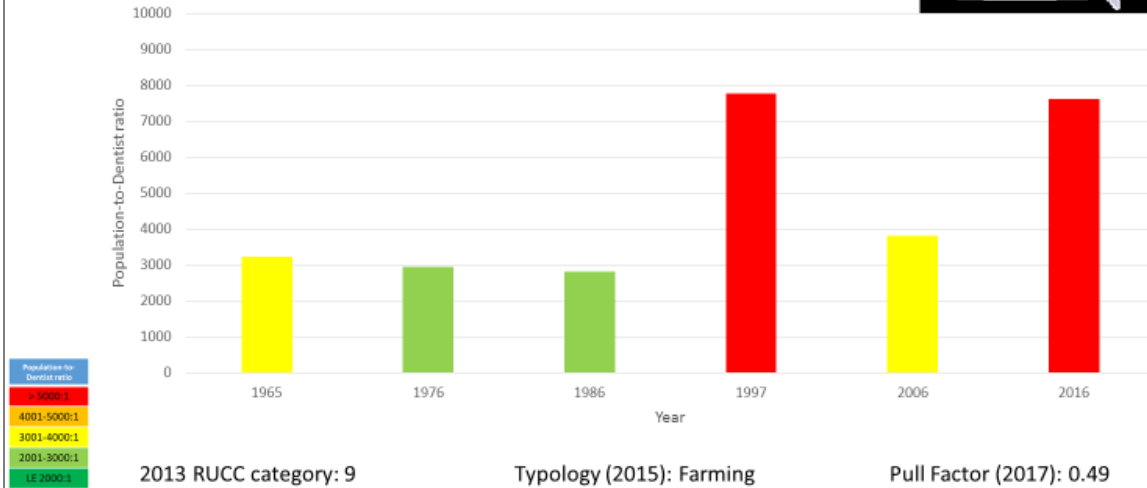
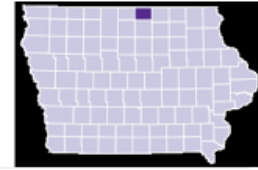
Population-to-Dentist Ratios, Iowa: Winneshiek County



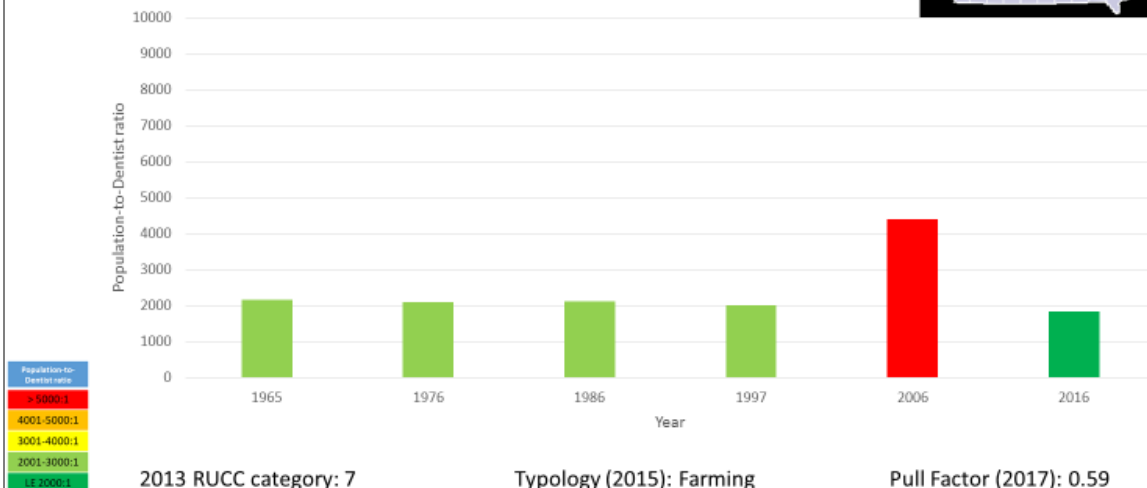
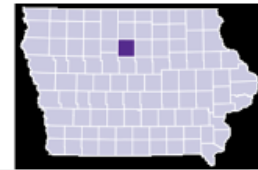
Population-to-Dentist Ratios, Iowa: Woodbury County



Population-to-Dentist Ratios, Iowa: Worth County



Population-to-Dentist Ratios, Iowa: Wright County



Articles Using Iowa Dentist Tracking System Data

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McKernan SC, Pooley MJ, Kuthy RA, Momany ET, Damiano PC. Iowa Dental Wellness Plan: Evaluation of Baseline Provider Network. Iowa City, IA: University of Iowa Public Policy Center;2015:26.

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Grants Using Iowa Dentist Tracking System Data

Funding Agency: Delta Dental of Iowa Foundation
Title: Create master database for dental workforce research and planning in Iowa

Principal Investigator: Raymond A. Kuthy
Dates: 2007-2008

Funding Agency: Health Resources and Services Administration, USDHHS
Title: Iowa's effort to improve oral health workforce activities

Principal Investigator: Raymond A. Kuthy
Dates: 2009-2012

Funding Agency: Delta Dental of Iowa Foundation
Title: Impact of geographic barriers on dental utilization by insured children in Iowa

Principal Investigator: Susan C. McKernan
Dates: 2013-2014

Funding Agency: Health Resources and Services Administration, USDHHS
Title: Coordinating and improving oral health workforce activities in Iowa

Principal Investigator: Raymond A. Kuthy
Dates: 2013-2016

Appendix

Iowa Workforce studies prior to the Iowa Dentist Tracking System

For those who are interested in additional historical dentist workforce information, we have included information from the Iowa Dental Association Manpower Committee, which was active between 1978 and 1987. The following tables and figures are the highlights from that committee.

Table 13. Questions in annual Iowa workforce study: 1979-1986

1. Sex
2. Birth Date
3. Race
4. Professional Education
5. Year graduated
6. Marital Status
7. Education: Highest degree or level attained in licensed field
8. How many years have you been active in licensed field?
9. Licensed by other states
10. Do you work in licensed field?*
11. Usual working status (self-employed; employed; not employed; retired)*
12. If self-employed (solo; group)
13. Type of practice (general; specialty – type)
14. Primary work location
15. How long have you worked at present location?
16. Primary work location in licensed field twelve months ago
17. Not working twelve months ago
18. Work setting (21 categories)
19. Major form of employment (government; non-governmental; other)
20. Weeks worked in past 12 months
21. Total hours worked per week

* If not working in licensed field (Q10) or retired or not employed (Q11), then did not complete the remainder of survey.

Other recurring questions

22. How many individual patients did you, the dentist, treat in a typical month?
23. How many NEW patients did you accept into your practice during the past year?
24. How many patient visits do you, the dentist, provide in a typical week?
25. What change, if any, in the number of patient visits would you like to make? (# increase, # decrease, no change)

26. What change, if any, did you make in personnel last year? (increase, decrease, no change)
27. How would you best describe your practice during the past 12 months? (too busy to treat all requesting appointments; provided care to all requesting it, but felt overworked; provided care to all requesting it, but did not feel overworked; not busy enough, would have liked more patients; practice limited, no new patients taken)
28. For the patients you treat, what type of payment do they use (in percent)? (private or industry insurance carriers; Title XIX, Medicaid, or similar programs; Delta Dental; private pay, fee for service)
29. Do you have a computer in your office? Do you use external computer services?
30. Do you have a satellite practice?

There was between 87.9% and 90.4% response to the annual surveys conducted by the Iowa Dental Association Manpower Committee during this time frame.

Table 14. Iowa workforce questions that were only asked once during annual survey, 1979-1986

| Year | Type of Question |
|------|--|
| 1979 | <ul style="list-style-type: none"> ▪ Need for more dental specialists |
| 1980 | <ul style="list-style-type: none"> ▪ Access for handicapped persons to the dental office ▪ Dentists' time spent performing dental functions ▪ Dental hygienist work patterns |
| 1981 | <ul style="list-style-type: none"> ▪ Describe type of dental practice ▪ Use of computer services |
| 1982 | <ul style="list-style-type: none"> ▪ Patient need and acceptance of periodontal treatment ▪ Time spent by dentist and hygienist to perform dental functions ▪ Number of periodontal referrals ▪ Number of patients with 6+ mm periodontal pockets ▪ Dentist's office hours and any changes made |
| 1984 | <ul style="list-style-type: none"> ▪ Treatment needs of patients 65 and older ▪ Dental care provided in non-office settings ▪ Problems patients 65 and older have regarding access to dental care ▪ Should dental hygienists be able to apply pit and fissure sealants under general supervision? |
| 1986 | <ul style="list-style-type: none"> ▪ Provided treatment to individuals with known diagnosis of infectious disease ▪ Use of barrier techniques ▪ Types of aseptic systems ▪ Provision of peripheral systems (e.g., blood pressure, oral cancer screening, TMJ services) |

Table 15. Demographic, education, and employment status of Iowa dentists, 1982-1987

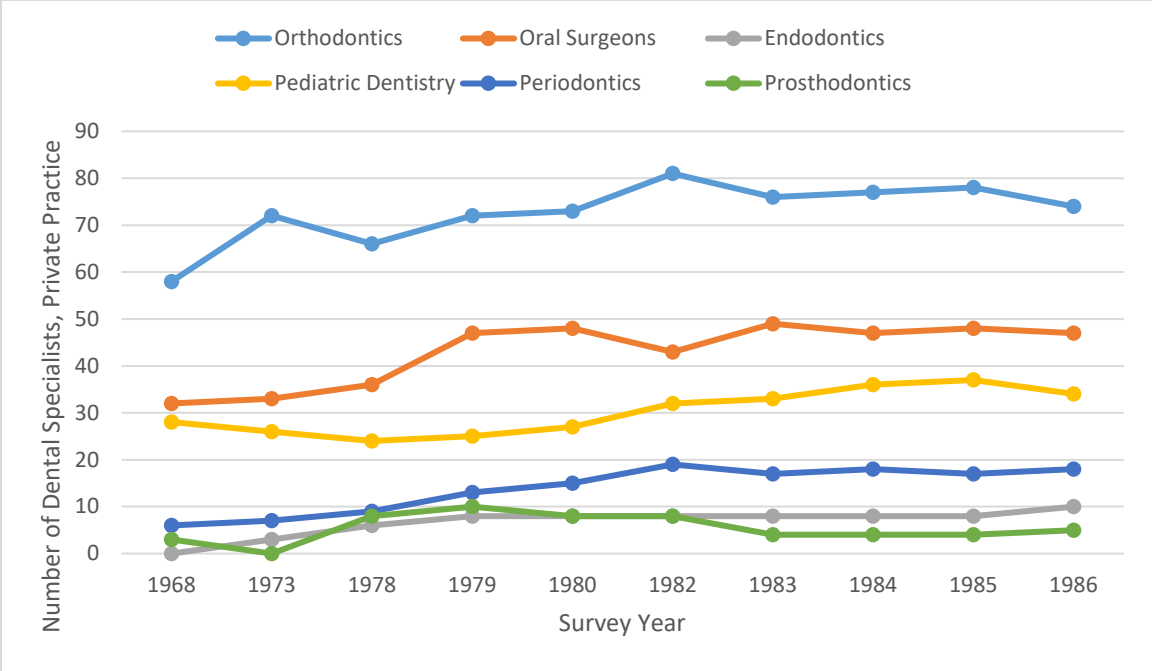
| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Male | 98% | 97% | 97% | | 97% | 96% |
| White | 99% | | 99% | | 99% | |
| University of Iowa graduate | 81% | | | 80% | 80% | 79% |
| Self-employed* | 90% | 92% | 92% | | 89% | 91% |
| Solo practice | | | 72% | 72% | 76% | 76% |

* Options for usual work status: self-employed, employed, and not employed.

Source: Summary reports from annual Iowa Dental Association Manpower Committee

Table 16. Median number of weeks worked per year and hours worked per week, Iowa private practice, 1973-1986

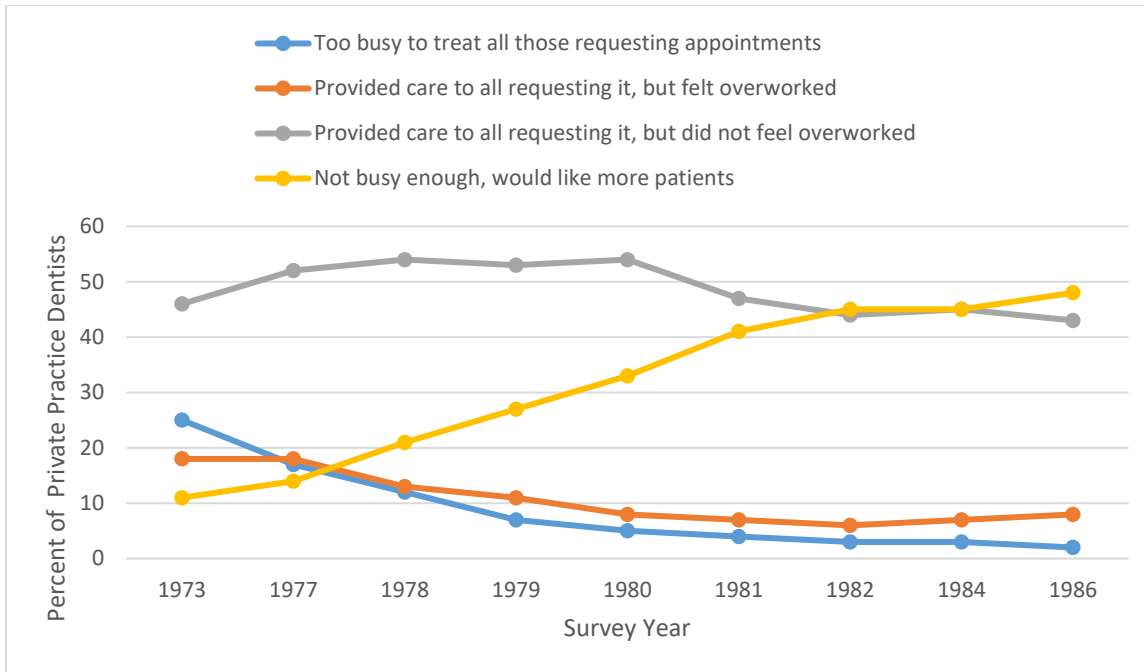
| Year | Median Patient Care Hours per Week | Median Weeks Worked per Year |
|-------------|---|-------------------------------------|
| 1973 | 38.4 | 47.3 |
| 1978 | 36.4 | 46.2 |
| 1980 | 36.5 | 47.4 |
| 1982 | 36.2 | 47.4 |
| 1984 | 36.9 | 48.1 |
| 1986 | 36.0 | 48.0 |



Source: Iowa Dental Association Manpower Committee

Figure 1366. Number of Iowa dental specialists in private practice, 1968-1986

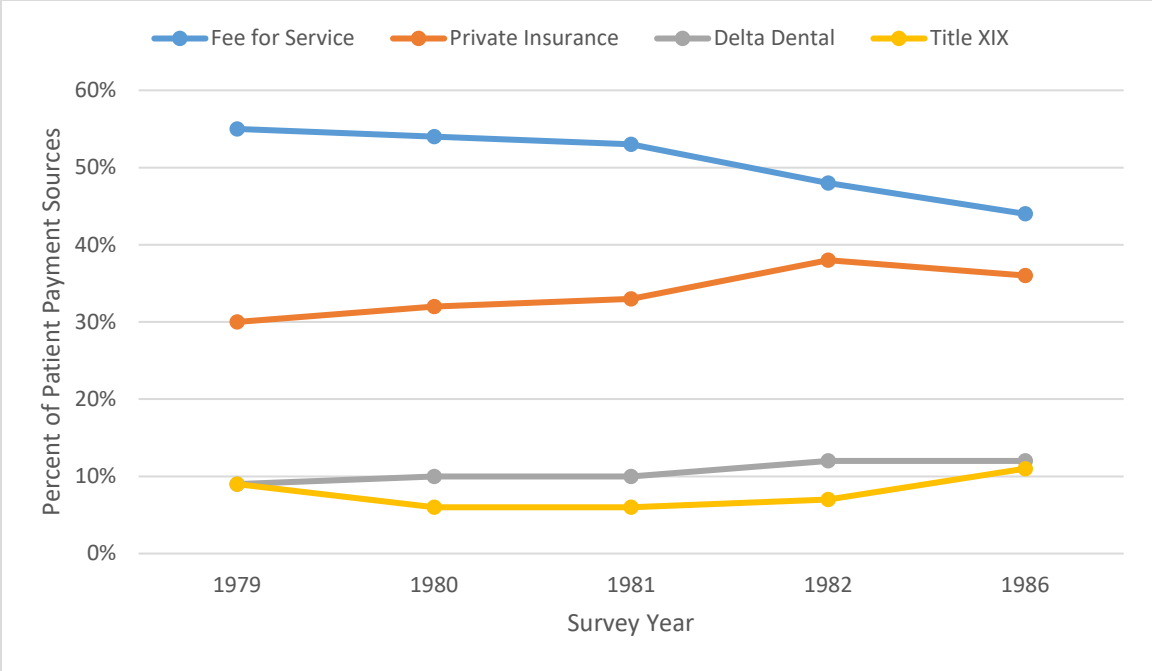
Note: The survey year dates on this graph are not consecutive.



Source: Iowa Dental Association Manpower Committee

Figure 1377. Iowa private practice perceptions about busyness, 1973-1986

Note: The survey year dates on this graph are not consecutive.



Source: Iowa Dental Association Manpower Committee

Figure 1388. Type of patient payment for dental services (%), Iowa private practice dentists, 1979-1986

Note: The survey year dates on this graph are not consecutive.