



FINAL REPORT OF FINDINGS

December 30, 2008

Prepared for the SOC Advisory Committee by:
Colorado Health Institute
1576 Sherman Street, Suite 300
Denver, Colorado 80203-1728
www.coloradohealthinstitute.org

Acknowledgements

Many individuals played important roles in the deliberations and final report of the Scopes of Care Advisory Committee, most importantly the members themselves. The consensus-building skill and evidence-based science expertise of its chair, Dr. Ned Calonge, chief medical officer of the Colorado Department of Public Health and the Environment, deserve special recognition. Dr. Calonge brought the committee through a number of potentially contentious discussions to a place where consensus was both possible and attained.

Jessica Waclawski, research assistant at the Colorado Health Institute (CHI), sat by Ned's side, supporting the work of the Committee with great finesse, cheerfulness and responsiveness as the many drafts of the final report were being written. Claire Brockbank and Deb Van Houten, consultants to CHI, were diligent in their reviews of the evidence supporting the practice of APNs and PAs as primary care providers and tracking down the additional facts necessary to support the findings of the report. Pam Hanes, president and CEO of CHI provided overall guidance to the staff and served as primary editor of the final document.

The staff and consultants of CHI would like to extend their heartfelt thanks to each committee member as their active engagement in the process and drafting of the final report made our work much easier and enjoyable. It was an honor to be a part of a process that will have policy significance for some time to come.

Finally, the Governor's Office would like to acknowledge The Colorado Trust and Caring for Colorado Foundation for their generous support of the Collaborative Scopes of Care study.

December 30, 2008

Table of Contents

| | |
|---|----|
| Acknowledgements | 2 |
| Executive Summary | 6 |
| Physician Assistants: Evidence from the Literature Review | 6 |
| Advanced Practice Nurses: Evidence from the Literature Review..... | 7 |
| Dental Hygienists: Evidence from the Literature Review | 9 |
| Policy recommendations from the SOC Advisory Committee..... | 10 |
| Dental Hygienists (DHs)..... | 10 |
| Advanced Practice Nurses (APNs)..... | 11 |
| APN Recommendations..... | 11 |
| Models of care policy recommendations | 11 |
| Reimbursement recommendations..... | 11 |
| Policy monitoring recommendations | 12 |
| Study Description | 13 |
| Background..... | 13 |
| Evidence-based Review Methods | 13 |
| Overview of Primary Care..... | 16 |
| Definition of Primary Care | 16 |
| A Brief History of Primary Care | 16 |
| Core attributes of primary health care..... | 18 |
| The role of primary care in improving population health..... | 19 |
| Cost-effectiveness of primary health care | 19 |
| Innovations found to improve primary care delivery | 20 |
| Access to primary care in Colorado..... | 22 |
| Primary Care Workforce: Evidence and efficacy | 23 |
| Physician Assistants..... | 23 |
| Physician Assistants: Evidence from the Literature Review | 25 |
| Advanced Practice Nurses..... | 26 |
| Nurse Practitioners (NPs)..... | 26 |
| Certified Nurse-Midwives (CNMs)..... | 27 |
| Certified Registered Nurse Anesthetists (CRNAs) | 28 |
| Advanced Practice Nurses: Evidence from the Literature Review..... | 31 |
| Dental Hygienists | 32 |
| Dental Hygienists: Evidence from the Literature Review | 34 |
| Collaborative Models of Primary Care Delivery..... | 35 |
| Examining Collaborative Models in Primary Health Care settings..... | 35 |

| | |
|--|----|
| Patient-centered medical home | 36 |
| Interdisciplinary team practice: Examples from the field | 36 |
| Telehealth and telemedicine | 37 |
| School-based health centers (SBHCs)..... | 37 |
| Community and migrant health centers (C/MHCs)..... | 37 |
| Examining Collaborative Models in Primary Oral Health Care | 37 |
| Colorado collaborative oral health care models | 41 |
| Safety net dental clinics | 42 |
| Non-traditional oral health care providers | 42 |
| Colorado oral health workforce data | 42 |
| Reimbursement Policies Related to Non-physician Providers..... | 43 |
| Medicare..... | 44 |
| Colorado Medicaid | 45 |
| Colorado CHP+ | 46 |
| Rural Health Clinics (RHC) and Federally Qualified Health Centers (FQHC)..... | 46 |
| Private Insurers..... | 46 |
| Evidence-based Policy Recommendations | 47 |
| Dental Hygienists (DHs)..... | 47 |
| Advanced Practice Nurses (APNs)..... | 47 |
| APN Recommendations..... | 48 |
| Models of care policy recommendations | 48 |
| Reimbursement recommendations..... | 48 |
| Policy monitoring recommendations | 49 |
| Appendix A: Executive Order | 50 |
| Appendix B: Collaborative Scopes of Care Advisory Committee Members | 54 |
| Appendix C Study Methods..... | 55 |
| Appendix D Screening Form for Literature Review | 57 |
| Abstract Scan | 57 |
| Full Article Review..... | 58 |
| Single Study | 58 |
| Meta-Analysis..... | 58 |
| Appendix E Summary of Common Themes and Issues Identified by Key Informant Interviews..... | 59 |
| Appendix F Maps of Primary Care Resources in Colorado..... | 62 |
| Appendix G Primary Care Professions Matrix..... | 74 |
| Appendix H Evidence-Based Summaries | 77 |
| Registered Dental Hygienist Evidence-based Summaries | 77 |

| | |
|--|-----|
| Study Characteristics..... | 81 |
| Advance Practice Nurse Evidence-based Summaries..... | 83 |
| Study Characteristics and Ratings..... | 100 |
| Physician Assistant Evidence-based Review..... | 106 |
| Study Characteristics and Ratings..... | 115 |
| Appendix I Miscellaneous Tables..... | 119 |
| Appendix J Regulatory Framework for Select Health Professions in Colorado..... | 130 |
| Physician Assistant Scope of Practice in Colorado..... | 130 |
| Advanced Practice Nurse Scope of Practice in Colorado..... | 131 |
| Dental Hygienist Scope of Practice in Colorado..... | 132 |
| Endnotes..... | 133 |

Executive Summary

On February 7, 2008, Governor Ritter issued Executive Order B 003 08 establishing the Collaborative Scopes of Care Study and creating an advisory committee to oversee the conduct of an evidence-based review that would inform the study findings. In issuing this executive order, the governor acknowledged that “it is clear from health manpower studies that we do not have sufficient numbers of providers, especially physicians and dentists, to meet the current [health care] needs of Coloradans. This problem is especially acute in rural and other underserved areas.” Further, Governor Ritter called for a research group to “undertake a study of scopes of practices for advanced practice nurses, physician assistants and dental hygienists in terms of the services that are delivered, the settings in which those services are delivered and the quality of care provided.”

The purpose of this evidence-based review is to assess studies that directly relate to the following three key research questions:

1. What are the quality, safety, efficacy and cost-effectiveness issues related to utilizing advanced practice nurses (APNs), physician assistants (PAs) and dental hygienists (DHs) as primary care providers, paying particular attention to the provision of primary care provided to underserved populations?
2. What is the quality, safety and efficacy evidence for utilizing independent practice certified registered nurse anesthetists (CRNAs) in anesthesia settings?
3. Are there models of care, care settings or aspects of care settings including relationships between different providers that have been shown to improve access to quality primary health care when employing APNs, PAs and DHs?

The focus of the study was collaborative models of *primary health care* delivery. The definition of primary health care utilized to answer the study questions was “basic physical, oral and mental health care provided by physicians, dentists and other health care professionals such as advanced practice nurses, physician assistants, certified nurse midwives and dental hygienists who are licensed to provide preventive, early intervention and continuous health care services. Primary care is ongoing and can involve the establishment of a medical home for individuals at all stages of the life course from pregnancy and childbirth through old age.”

For the purposes of this study, obstetrics, gynecological and anesthesia care provided in rural areas in particular were included in the evidence-based review because of the unique obstetrics and anesthesia access to care issues that are encountered in many rural areas of the state.

Physician Assistants: Evidence from the Literature Review

The literature search identified a total of 430 articles. From these articles, 27 qualified for a full article review and nine studies were considered to have sufficient evidence to be included in the report. Three of the nine articles were also included in the APN review where PAs were included in the study design.

All of the studies were observational. Five articles grouped PAs with NPs together and assessed quality, outcomes and/or processes of care relative to that provided by physicians. The heterogeneity of the studies limited our ability to present a set of findings across the studies related to specific aspects of quality, outcomes or efficacy.

PA studies generally occurred prior to 1980, when the profession was young and resulted in an emerging literature as evidenced in the studies identified through the literature search tools. PAs

practice under state medical practice acts and as such have a statutorily defined relationship with a supervising physician; thus, controlled experiments concerning scope of practice are less frequent than for other non-physician primary care providers such as NPs and certified nurse-midwives (CNMs) who function under a separate practice act.

Quality of care

The quality of care in the studies reviewed was found to be comparable between PAs, NPs and physicians, particularly with regard to diabetic care. Other differences, however, were noted between NPs and PAs.^{1,2} For example, an analysis of data from the National Ambulatory Medical Care Survey (NAMCS) for the period between 1997 and 2002 found a significantly larger proportion of NPs practicing in primary care settings when compared to PAs (60% vs. 31%). Another study found that PAs were more likely than NPs to work in a community health center. Still another study found NPs were significantly more likely to assess HbA1c and lipid levels in their diabetic patients than PAs (80% vs. 58%) and that these assessment rates were similar to those of physicians.³

Processes of care

The process of care outcomes most often studied included prescribing, referrals and practice patterns. One study found that a large majority of PAs appropriately were referring their patients to a physician for follow-up care—79% referred up to 10 patients a week to their supervising physician and 75% referred a similar number of patients to a non-supervising consulting physician each week.⁴ In the analysis of NAMCS data, researchers found that PAs practicing in a rural area prescribed fewer medications than those practicing in an urban area as well as fewer than NPs and physicians practicing in rural areas. The mean number of medications recorded per visit was similar across all provider types. PAs and NPs at tertiary hospitals in Ohio and Pennsylvania included in one study were more likely to include a patient's social history in admission notes than physicians to whom they were being compared.

Patient satisfaction

Only one study analyzed patient satisfaction within a closed panel model HMO. An 8-item questionnaire was administered to patients to assess satisfaction with their primary care provider type and no statistical differences were found between physician and non-physician providers.

Access to care

Two of the studies reviewed discussed dimensions of access where type of payment was found to increase the likelihood of utilizing a PA or NP with the exception of payments within an HMO that increased the likelihood of utilizing a physician. Practicing in a rural setting had a significant and positive impact on the use of PAs and NPs for a primary care visit, but the study was conducted in a hospital outpatient clinic, thus limiting the application of the study's findings to other care settings.⁵ In a study undertaken in California and Washington, PAs were significantly more likely than physicians to work in a rural area, including health professional shortage areas (HPSAs). PAs were also more likely to provide care to vulnerable populations.⁶

In general, the studies reviewed found no significant differences in patient outcomes or satisfaction with the care provided by PAs when compared to physicians.

Advanced Practice Nurses: Evidence from the Literature Review

The literature search returned a total of 1,116 articles—778 related to NPs, 191 related to CNMs and 147 related to CRNAs. From these articles, 122 qualified for a full article review which produced 17 studies that met the criteria to produce an evidence basis. Twelve studies were specific to NP practice,

four to CNM practice and three to CRNAs. Two of the studies examined both NP and CNM practice in a community setting.

Twelve studies took place in a primary care setting and five in a hospital setting. One intervention occurred in Colorado, while two of the three systematic reviews were conducted in the United Kingdom, all of which contained studies conducted in the U.S. Ten studies dealt exclusively with an adult population, four included a pediatric population and in the three meta-analyses, the patient populations were not specifically discussed. One systematic review focused on the quality of care provided by NPs and CNMs relative to physician care. Three studies were randomized case-control studies that compared the outcomes associated with NP care versus that of physicians. There was sufficient heterogeneity between the studies that a common and/or consistent set of findings with regard to processes and quality of care did not emerge from the evidence-based review.

Quality of care

Consistent with earlier systematic reviews of APNs, the two meta-analyses reviewed by CHI staff found that NPs deliver comparable quality of care to that provided by physicians with regard to the outcomes measured. One of the studies reviewed in the first meta-analysis examining the role NPs and NMs in primary care included studies related to NP/NM teams, NP/physician teams and NM/physician teams practicing in primary care settings.⁷

The Horrocks (2002) systematic review included studies that compared NPs and physicians providing first point of contact care in primary care settings. The models of care were not specifically referenced in the review but rather various outcomes were compared between the two types of practitioners.⁸ In general, this meta-analysis included evaluations of APNs functioning either as members of an interdisciplinary health care team or in a collaborative relationship with a physician or other primary care professionals.^{9,10}

In one study (Ohman-Strickland, 2008), the research design specifically looked at family medicine practices that employed NPs, PAs or neither and compared outcomes across the various types of practices including physician-only practices. Two studies focused specifically on diabetic patients where NPs were found to be more likely to monitor HbA1c and lipid levels than physicians. In one study, diabetic patients who were managed by a NP/physician team demonstrated significant improvements in long-term diabetes control reflected in decreased HbA1c levels. In this study, 66% of NPs assessed HbA1c levels compared to 49% of physicians; and 80% of NPs assessed lipid levels compared to 68% of physicians.

In the studies that met the evidence-based review criteria, nurse-midwives and CRNAs had equivalent quality of care when compared to physicians. Study design and data limitations did not allow for generalizations of comparative quality between physicians and APNs, particularly with regard to specific populations such as older adults at one end of the age continuum and children at the other end.

Process of care

Process of care outcomes included in the studies reviewed were: time spent with patients, prescribing practices and frequency of ordering of diagnostic tests. NPs were found to spend more time with patients, averaging 11.57 minutes compared to physicians who spent an average of 7.28 minutes per patient. The researchers did not report productivity measures.¹¹ In the Venning et al. (2000) study, no significant differences were found in prescribing practices of NPs and physicians, but NPs ordered more tests than physicians and were significantly more likely to schedule a follow-up visit.¹² In the Litaker study, NPs scored higher on measures of providing preventive care and patient education than

physicians.¹³ The Brown and Grimes (1995) meta-analysis found that in low-risk births attended by CNMs, women received less analgesia, anesthesia and fetal monitoring and fewer episiotomies, forceps deliveries and intravenous fluids. There were no studies that specifically measured processes of care for CRNAs versus anesthesiologists. In the studies where relative costs were discussed, when practicing alone APNs cost less, but when practicing on a team costs were higher than physicians practicing alone.¹⁴

Patient satisfaction

Health service utilization and patient surveys were used to measure satisfaction in nine studies. Patient satisfaction was consistently and significantly higher for NPs, especially when measuring satisfaction with patient education and treatment plans. CNMs received higher satisfaction ratings than obstetricians.¹⁵ In general, the studies reviewed found higher levels of patient satisfaction with NPs and higher satisfaction ratings for patient education provided by NPs. NPs were found to spend more time with their patients, which was hypothesized to explain, in part, the higher patient satisfaction scores they achieved. There were no studies measuring satisfaction with care and services provided by CRNAs versus anesthesiologists.

Access to care

Four studies discussed access to primary care but due to the heterogeneity of settings in the studies reviewed, they could not be directly compared or similar conclusions drawn. One urban-based study found access to prenatal care for indigent women was increased when compared to a non-intervention group (52.5% vs. 44.6%).¹⁶ Another study comparing primary care physicians and non-physician primary care providers in California and Washington found that a greater proportion of NPs and CNMs in California worked in a rural area or HPSA compared to physicians. These non-physician primary care providers also served a greater proportion of Medicaid, uninsured and minority patients in their practices than the physicians included in the study.¹⁷ Like Colorado, California requires a collaborative agreement for prescriptive authority between an APN and physician. A study comparing CRNA-only hospitals with anesthesiologist-only hospitals found that CRNAs served a greater percentage of Medicaid patients than anesthesiologists (43% vs. 30%).¹⁸

Dental Hygienists: Evidence from the Literature Review

The literature search returned a total of 410 articles of which 30 qualified for a full article review. The full article review produced five articles that were included in the evidence-based findings.¹⁹ All five of these articles received a fair rating by CHI reviewers. Three of the five articles reported on the same study, but reported on different aspects of the study findings: quality of care, patient satisfaction and patient demographics.

The *Health Manpower Pilot Project* conducted in California in 1987 was the first study of its kind to evaluate the quality of independently practicing dental hygienists under statutory pilot authority granted by the California Legislature which specified that prior to making changes in health personnel licensure, pilots should be conducted to produce an evidence basis for recommended changes. Although Colorado allowed the independent practice of dental hygienists and Washington permitted such practice in institutional settings in 1987, no studies had been conducted to assess the impacts on access or the quality of care provided by independently practicing dental hygienists. It was consistently noted that evidenced-based research about the independent practice of dental hygiene was negligible prior to this study.

Quality of care

The California study compared the quality of care provided by dentists in six dental practices and in nine independent dental hygienist practices by randomly selecting and reviewing, through chart audits and

225 patient records, the quality of care provided.²⁰ Dental hygienists outperformed dentists on several quality indicators including appropriate follow-up to medical concerns, maintaining complete and up-to-date patient medical and oral health histories and administration of radiographs. In summary, the demonstration project found no differences in quality of care although it was forced to end the project prematurely because of a lawsuit brought by the California Dental Association.²¹

A second parallel study conducted in Colorado found the quality of care to be at least equivalent and at times better than that provided by dentists in the areas of completeness of medical histories, appropriateness of recorded patients' caries status, recorded soft-tissue findings and periodontal status. The evidence from these studies found that independently practicing dental hygienists were able to competently provide dental hygiene services within their scope of practice based on their education and training. The studies also found that independently practicing hygienists increased patient referrals to the dentist and had better patient follow-up rates.

Patient satisfaction

The vast majority of patients being seen by a dental hygienist in the studies reviewed were satisfied with the care they received, found their hygienists' examinations to be thorough and were satisfied with the fees charged.

Policy recommendations from the SOC Advisory Committee

DENTAL HYGIENISTS (DHs)

FINDINGS FROM EVIDENCE-BASED REVIEW - The evidence found that dental hygienists in unsupervised practice can competently deliver a range of oral health care preventive services including dental hygiene care such as teeth cleaning, application of fluoride varnishes and sealants within their scope of training, education and licensure in Colorado. Further, that the quality of care provided by dental hygienists is at least comparable to that provided by dentists, primarily in the areas of prevention and maintenance of healthy oral hygiene practices. It also was found that unsupervised practicing hygienists facilitated referrals to dentists for follow-up care.

UNRESOLVED PRACTICE ISSUE - DHs practicing within the full scope of their license, as defined in statute and evidenced by successful completion of their required education and knowledge base, face a current statutory restriction with regard to making a dental hygiene diagnosis, specifically in the situation where a DH could inform a patient or the parent of a child patient about the presence of caries or gum problems. Although DHs receive education in the evaluation, identification and dental hygiene diagnosis of oral hygiene-related diseases, they are unable to specifically inform the patient, parent or guardian for example, that the reason a sealant cannot be applied to their teeth or their child's teeth is due to the presence of dental caries. Of the six other states where DH practice acts were examined, none permitted that a dental hygiene diagnosis could be completed by a dental hygienist.

Resolving this issue could enable more specific, accurate and timely communication between patients and dentists upon referral by a licensed dental hygienist. A dental hygiene diagnosis could motivate the patient and provide a sense of importance to seeking necessary follow-up evaluation and care. On the other hand, an inaccurate dental hygiene diagnosis could lead to an unnecessary referral and delayed treatment of an undiagnosed condition, possibly increasing malpractice liability for a dentist who accepts referrals from dental hygienists. As there is no strong evidence basis for either of these possible scenarios, changes in policy must be supported by careful consideration of the balance between potential benefits and potential harms, both important quality of care issues.

BARRIERS TO PRACTICE - Reimbursement policies wherein not all dental payers in the state directly reimburse DHs for services provided and authorized under their current scope of practice have been identified as a potential barrier to practice, although there may be additional factors that impede dental hygienists' ability to provide care within their scope of education and training in settings of limited dental care access.

DH Recommendation – The SOC Advisory Committee recommends that an evaluation be conducted and options recommended for reimbursement policies which would enhance the use of dental hygienists in areas where oral health access is lacking.

ADVANCED PRACTICE NURSES (APNs)

FINDINGS FROM EVIDENCE-BASED REVIEW - The evidence-based review found that APNs working as members of interdisciplinary health care teams deliver quality health care comparable to physicians in a variety of settings while receiving high patient satisfaction ratings. CNMs and CRNAs were found to provide quality specialty care without the direct supervision of a physician, often operating under specific practice protocols developed in consultation with a licensed physician. Further, that consultation and referral to other appropriate providers consistent with training and scope of practice is a necessary component of primary health care to be exercised by all primary care providers.

BARRIER – A barrier to APN practice that was identified by members of the advisory committee, key informants and through public testimony was that some APNs, particularly those practicing in rural areas, find it difficult to identify physicians willing to enter into a collaborative agreement for purposes of prescriptive authority. Various reasons for this difficulty have been put forth, ranging from a shortage of primary care physicians in certain geographic areas, a lack of knowledge and understanding about the legal implications of the collaborative agreement, financial constraints imposed upon APNs when they must pay for the agreement and general liability concerns from both physicians and APNs.

APN Recommendations

1. Evaluate the efficacy of changes to APN law and regulations that would allow more flexibility in, or other changes to, the collaborative agreement requirement for prescriptive authority by APNs that would address the identified barriers.
2. Evaluate and recommend policies that would support and enhance the delivery of health care through interdisciplinary teams including physicians, APNs and other health care professionals.

CRNA Recommendation – Evaluate the efficacy of implementing changes currently authorized under the federal opt-out provision for Medicare Part A reimbursement to allow Colorado hospitals to bill for CRNA services directly taking into account hospital location and CRNA practice experience.

MODELS OF CARE POLICY RECOMMENDATIONS

Oral Health Recommendation – Consider conducting a feasibility study to evaluate the costs, benefits and quality of care considerations for Colorado to develop training programs for Community Dental Health Coordinators, Advanced Dental Hygiene Practitioners and/or Dental Therapists as a means of expanding access to primary oral health in the state.

REIMBURSEMENT RECOMMENDATIONS

UNRESOLVED ISSUE - Colorado statutes (CRS 10-16-104) require that dental care plans reimburse for any service that may be lawfully performed by a person licensed to practice in Colorado. DHs were specifically referenced in this regulation to ensure that insurance carriers doing business in Colorado

honor the individual scopes of practice of oral health care providers. However, dental carriers have argued that they are not insurance companies and are therefore exempt from this provision.

Colorado statute also indicates that an insurance company shall not be precluded from setting different fee schedules for different services performed by different health professionals, but that the same fee schedule shall be used for those health services that are substantially identical although performed by different professionals. The State of Colorado reimburses all licensed health care providers at the same rate for the same services provided under the Medicaid program. However, based on anecdotal information from private payers, this rule does not appear to be uniformly practiced among all private insurers.

Reimbursement Recommendation – Consider adding to the current reporting requirements imposed by HB 08-1389 a provision that would require insurers to disclose to the Colorado Insurance Commissioner their reimbursement policies regarding the reimbursement of allied health professionals providing identical services to physicians and dentists within their respective scopes of practice.

Reimbursement Recommendation – Consider requiring all vendors contracting with the State of Colorado for individuals covered by state-sponsored insurance programs and state-funded programs that directly deliver services to children and adults provide direct reimbursement to DHs and APNs for services provided within their respective scopes of practice.

POLICY MONITORING RECOMMENDATIONS

PROBLEM – Effective and informed policymaking assumes the availability of objective and reliable data, both to frame policy options and then to monitor the implementation of policies once enacted. In spite of recent foundation investments in health professions data, Colorado still suffers (as do most other states) from significant data deficits in the area of health professions workforce data. These data deficits result in sub-optimal estimates of workforce supply and the distribution of Colorado’s primary care workforce.

Data Collection and Policy Monitoring Recommendation – The governor and/or legislature should consider sponsoring legislation that would require the health professions licensing boards housed in the Department of Regulatory Agencies to collect additional information from all applicants for a new or renewed Colorado license such as practice setting (e.g., community health center, private clinic, solo practice, school-based health center), practice address, years in active practice, certifications held, date of birth, highest degree held and/or others to be determined.

UNRESOLVED ISSUE – Upon completion of an evidence-based review of the literature, one which employed rigorous standards for study inclusion, CHI staff has found that a consistent and generalizable body of evidence that can be applied to a Colorado context is lacking. The studies reported in the peer-reviewed literature have been conducted in select care settings and with specific population groups, thus limiting their application across populations and care settings.

Recommendation to build a Colorado-specific evidence basis for collaborative models of primary care - While negotiations continue to take place around elements of the Nurse Practice Act and the scope of practice of dental hygienists, the governor and/or legislature should consider authorizing demonstration projects to test the efficacy, safety and quality of care provided by APNs, PAs and dental hygienists as primary health care providers in medically underserved areas of Colorado. These studies should employ the highest standards of clinical and health services research to provide definite evidence of the processes and outcomes of care associated with various models of collaborative, interdisciplinary primary care practice.

Study Description

BACKGROUND

On February 7, 2008, Governor Ritter issued Executive Order B 003 08 establishing the Collaborative Scopes of Care Study and creating an advisory committee to oversee the conduct of an evidence-based review that would inform the study findings (see Appendix A). In issuing this executive order, the governor acknowledged that “it is clear from health manpower studies that we do not have sufficient numbers of providers, especially physicians and dentists, to meet the current [health care] needs of Coloradans. This problem is especially acute in rural and other underserved areas.” Further, Governor Ritter called for a research group to “undertake a study of scopes of practices for advanced practice nurses, physician assistants and dental hygienists in terms of the services that are delivered, the settings in which those services are delivered and the quality of care provided.”

The first meeting of the Collaborative Scopes of Care Advisory Committee occurred on April 16, 2008, and the final meeting was held on December 18, 2008. Members of the SOC Advisory Committee and their affiliations can be found in Appendix B to this report.

EVIDENCE-BASED REVIEW METHODS

Analytical framework

Key questions addressed in the study

The purpose of this evidence-based review is to assess studies that directly relate to the following three key research questions:

1. What are the quality, safety, efficacy and cost-effectiveness issues related to utilizing advanced practice nurses (APNs), physician assistants (PAs) and dental hygienists (DHs) as primary care providers paying particular attention to the provision of primary care provided to underserved populations?
2. What is the quality, safety and efficacy evidence for utilizing independent practice certified registered nurse anesthetists (CRNAs) in anesthesia settings?
3. Are there models of care, care settings or aspects of care settings including relationships between different providers that have been shown to improve access to quality primary health care when employing APNs, PAs and DHs?

Definitions of terms

Terms used in the previously stated questions vary widely in their definitions. The following definitions were used in this literature review.

- Efficacy—the ability to create a desired outcome under optimal (controlled) conditions.
- Effectiveness—the ability to demonstrate efficacy under normal (“real world”) conditions.
- Health care quality—in the context of delivering health services, an identifying characteristic with an inherent degree of excellence or that compares favorably in measurement against a standard of care.
- Safety—the characteristic of a practice or treatment relating to a low incidence of adverse reactions and significant side effects and a low potential for harm under conditions of widespread use and availability.

- Cost-benefit—when the economic benefits of an intervention outweigh the cost of delivering the intervention.
- Cost-effectiveness—a measure of the costs associated with achieving a certain outcome.
- Cost-effective—used to describe an intervention for which the costs of achieving a given benefit is below an agreed upon acceptable level.
- Health outcome—the change in health that results from an intervention.
- Availability—the location and accessibility of a health care service near the population it serves. For example, a health care facility is available based on the hours and days it is open, the degree to which it can tolerate visits made without appointments and the extent the population perceives these aspects to be convenient.
- Access—is the degree to which health services are available and can be used by members of a population. It is possible to have available services that are not accessible. For example, a health care facility is accessible if it serves individuals regardless of whether they have private or public insurance or have no insurance to pay for the costs of care.
- Interdisciplinary models of care—when health care is coordinated across several disciplines in a team approach and where joint problem-solving and care management techniques are maximized. The competencies of each team member are joined to provide comprehensive, continuous, appropriate and quality care to patients and their presenting conditions.
- Underserved populations—those with inadequate or no private or public health insurance coverage and/or who face social or cultural barriers to the physical, oral and mental health care they need to stay healthy.
- Primary care—basic physical, oral and mental health care provided by physicians, dentists and other health care professionals such as advanced practice nurses, physician assistants, certified nurse midwives and dental hygienists who are licensed to provide preventive, early intervention and continuous health care services. Primary care is ongoing and can involve the establishment of a medical home for individuals at all stages of the life course from pregnancy and childbirth through old age.

Systematic literature review

Literature Search Strategy

A comprehensive literature search was guided by the three key research questions noted above. The following databases were consulted: PubMed, JSTOR, Medline and EBSCO. Key words relating to selected providers included “advanced practice nurse,” “nurse practitioner,” “physician assistant,” “dental hygienist,” “clinical nurse specialist,” “certified nurse midwife” and “certified registered nurse anesthetist.” A wide variety of search terms was used to capture the many dimensions of efficacy and effectiveness such as *quality, safety, cost-effectiveness, health outcomes and access* and associated terms identified in the literature. The literature review was restricted to studies involving community-based primary care and hospital and outpatient-related anesthesiology in both rural and urban settings. Further, the studies were related specifically to workforce issues such as education and training, demonstrated clinical competencies, licensure requirements, scope of practice and comparable health outcomes between physicians and non-physician providers.

Governmental studies and those funded by foundations and others that do not appear in peer-reviewed journals are often referred to as “gray literature.” These studies and reports vary in the degree of rigor and research methods employed. In many cases, the research methods and data collection and analysis are of comparable rigor to those that make their way into the published literature. Attempts were made to identify and screen these studies as well as those that appear in the above-mentioned literature search engines.

Relevant studies identified from 1980 to 2008 were included in the search, with an emphasis on studies published since 2000. Bibliographies of the reviewed articles were examined to supplement the computer search [For a complete discussion of Study Selection methods, see Appendix C; for the Literature Review Scoring Sheets, Appendix D]

Key informant interviews

A list of 29 key informants was developed by CHI with input from the Collaborative Scopes of Care Advisory Committee. Informants included representatives from a variety of health care settings throughout rural and urban Colorado including hospitals, physicians’ offices and safety net providers; university faculty and insurers were also included. A broad spectrum of professionals acted as key informants including physicians, advanced practice nurses, physician assistants, dentists, dental hygienists, academicians, consumer advocates and health policy experts.

Interviews with key informants were conducted by CHI staff who utilized a prepared list of questions. Confidentiality was guaranteed, with all informants assigned a unique blinded identifier. Informants were allowed to review the notes from their interviews to ensure accuracy. Once all interview notes were tabulated, CHI staff extrapolated and summarized the common themes and specific issues that key informants recommended be addressed in the models of care discussed in the final report of findings.

Key Informant Interview Questions

1. Knowing what you do about the Governor’s executive order, what do you consider to be the major goals of the study and the key issues that must be addressed?
2. What do you believe are appropriate and preferred collaborative roles for physicians and dentists and non-physician, non-dentist health care providers that can expand access to basic primary care services for Coloradans? Are there particular models of care with which you are familiar that could be promoted to strengthen these practice collaborations?
3. Do you have any concerns about quality of care that must be addressed while we examine scopes of practice and best practice models of care that utilize non-physician [non-dentist] practitioners?
4. What changes in scopes of practice do you believe are necessary to promote these new models of care and collaborative practice arrangements? Are there other policy issues that must be addressed such as reimbursement policies over which the state has legal authority?
5. What do you consider to be the major barriers, political or otherwise, to promoting new models of care through expanded utilization of non-physician [non-dentist] primary care providers?
6. Do you have any other thoughts on topics we haven’t covered that you consider to be important to address in the study?

The purpose of the key informant interviews was to supplement expert opinion about scopes of practice beyond the Advisory Committee (AC) to ensure the inclusion of various points of view from key influencers beyond the appointed members. Common themes/admonitions identified through the interviews included:

- The study should address the regulatory, political and educational dimensions of the practice environment including malpractice, public and private reimbursement policies and the effect of educational preparation on the quality and acceptability of non-physician/dentist primary care providers in delivering health care;
- The report findings should focus on promising innovative, interdisciplinary models of care in team-based primary care delivery; and,
- The concept of the medical home which incorporates the availability of comprehensive and continuous care for populations should be emphasized when examining models of care. [A summary of key informant interviews can be found in Appendix E]

Overview of Primary Care

DEFINITION OF PRIMARY CARE

For the purposes of this study, primary health care is defined as:

Basic physical, oral and mental health care provided by physicians and other health care professionals such as advanced practice nurses, physician assistants, certified nurse-midwives, dentists and dental hygienists who are licensed to provide preventive, early intervention and continuous health care services. Primary health care is ongoing and can involve the establishment of a medical home for individuals at all stages of the life course from pregnancy and childbirth through old age.

Primary care is further defined as the provision of integrated, accessible health care services by clinicians trained to address a large majority of personal health care needs.^{22,23} Primary health care emphasizes health education, prevention and wellness, as well as screening for the early detection of disease.²⁴ Sustained relationships between patients and clinicians are an important component of primary health care.²⁵ Bio-psychosocial models of primary health care stress patient-centeredness, interdisciplinary teams and a holistic approach to health.²⁶

A BRIEF HISTORY OF PRIMARY CARE

As early as 1892, William Osler, a father of modern medicine, warned that “the failure to recognize that the results of specialized observation are at best only partial truths, which require to be corrected with facts obtained by wider study... . No more dangerous members of our profession exist than those born into it, so to speak, as specialists.”²⁷ This admonition must be put into a 21st century context. The explosion of knowledge that informs modern medicine and the diagnosis and treatment of acute conditions and chronic diseases has made it impossible for a single physician to appropriately and safely treat the complexities of ill health found in many patients. Modern medicine has evolved considerably since Osler’s time in recognizing the balance that needs to occur between highly specialized *medical care* and comprehensive, holistic primary *health care*.

Beginning in the early 1970s, a critique of specialization in organized medicine was emerging which questioned the increasing trend toward compartmentalized, fragmented and specialized medical care. This critique was particularly focused on medical education and the growing number of specialty and

sub-specialty residency training programs that characterized medical education in the preceding decades.²⁸ During the 1970s, the first medical residency programs in family medicine, general internal medicine and general pediatrics were established.²⁹

A landmark event, the 13th Annual Meeting of the World Health Assembly held in 1977, unanimously set a social target for member governments that by 2000 “all citizens of the world” should attain a level of health that would allow them to lead socially and economically productive lives. The consensus reached at this meeting about the importance of primary health to achieve this goal is worth noting because it continues to be pointed to as a fundamental goal for any country’s health care delivery system, whether an agrarian, industrialized or post-industrialized nation. The World Health Organization (WHO) described primary care as:

Essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community by means acceptable to them and at a cost that the community and the country can afford to maintain at every stage of their development in a spirit of self-reliance and self-determination. It forms an integral part of both the country’s health care system of which it is the central function and the main focus of the overall social and economic development of the community. It is the first level of contact of individuals, the family and the community with the national health system, bringing health care as close as possible to where people live and work and constitutes the first element of a continuing health care process.” (WHO, 1978)

Table I below is adapted from Starfield (1992) who adapted it from Vouri (1984) and is intended to highlight the differences between a purely medical focus and one that focuses on the maintenance of health. It graphically displays the vision set forth by the World Health Organization (WHO) in 1978 by juxtaposing the concepts of primary *medical* care with primary *health* care. This framing serves as an appropriate model for the Collaborative Scopes of Care Study which has as its charge to examine collaborative models of care that will expand access to primary health care, particularly in Colorado’s underserved communities.

Table I. From primary medical care to primary health care

| Medical Care Focus | Health Care Focus |
|---|---|
| Illness Cure | Health Prevention and care |
| Medical Content | Health Content |
| Treatment Episodic care Specific problems | Health promotion Continuous care Comprehensive care |
| Medical Organization of Care | Health Organization of Care |
| Specialists Physicians and dentists Autonomous practice | General practitioners APNs, PAs and DHs Collaborative, team-based |
| Medical Care Responsibility | Health Care Responsibility |
| Medical sector alone Physician dominance Passive patient role | Intersectoral collaboration Community participation Individual responsibility |

Adapted from: Starfield, B. *Primary Care: Concept, Evaluation and Policy*, 2002.

Beginning in the 1980s, increasing numbers of nurse practitioners and physician's assistants have been trained as integral members of primary health care teams.³⁰ Working within their scopes of practice, these primary health care professionals have expanded access to primary care, largely to underserved populations, but also increasingly within integrated care organizations such as HMOs, community health centers, school-based health centers and private multi-specialty clinics. The U.S. Bureau of Labor Statistics' (BLS) most recent projections for the non-physician primary care workforce estimate a 27% increase in demand for PAs between 2006 and 2016 and note that this is a much faster rate of increase than most other professional categories. The projected increased demand for outpatient and ambulatory care RNs is even faster (34% increase for out-patient nurses and 39% increase for ambulatory care nursing) with a lower rate of increase during this time period estimated for hospital-based nursing (22%). Similar, but less dramatic, the BLS projects a 14% increase in demand for physicians and surgeons during the same time period.³¹

While the supply of non-physician primary care clinicians has increased moderately over time, the number of primary care generalist physicians has fallen by approximately one-third. In 1991, only 14.6% of medical students reported their plans to pursue a residency in primary care.³² The percent of medical students matching with a primary care specialty declined further in the early 1990s, primary care matches peaked at 53% in 1998 and declined to 44% by 2002.³³ Workforce experts highlight the difficulties in projecting physician demand, including accounting for secular trends that impact the demand for physician services such as increasing consumer demand, changing economic circumstances that drive demand for medical care and changing rates of insurance coverage which also affect demand. The impact of expanding insurance coverage on primary care shortages has been graphically illustrated in the recent Massachusetts health reform experiment where insurance coverage has been significantly expanded, resulting in notable access problems as newly insured individuals cannot find providers that will accept new patients.³⁴

CORE ATTRIBUTES OF PRIMARY HEALTH CARE

The primary care literature evolving since the mid-1970s has variously defined the core components and attributes of primary health care. From this literature a commonly held array of attributes has emerged. Interestingly, these same attributes have been used more recently to define "medical home." In many ways, by reviewing the brief history of primary care provided above, policymakers can easily see the historic roots of the medical home movement. Attributes of primary health care include:

- First contact care
- Comprehensive
- Longitudinal
- Coordinated
- Continuous
- Accountable
- Integration of physical, psychological and social aspects of health
- Patient-centered, relationship-based, including personal responsibility
- Accessible when needed (equitably distributed)
- Prevention-oriented
- Team-based, interdisciplinary collaboration
- Referral mechanisms in place depending on problem statement and diagnosis
- Chronic care management

Of all the core attributes of primary health care, Starfield and colleagues point to *coordination* as essential and key for attaining the other components of a primary health care system. As they note, "Without it, longitudinality would lose much of its potential, comprehensiveness would be difficult and the first contact function would become purely administrative."³⁵ A key component of coordination of care that

has been receiving increasing attention since 2000 is the importance of electronic medical records to ensure that coordination occurs across providers, settings and time.

A further observation noted by Starfield is that in spite of the high salience of the referral process from both a continuity and cost-of-care perspective, relatively few studies in the United States have been undertaken that empirically examine this dimension of primary care. A 1984 study found that consulting physicians communicated back to referring physicians only 55% of the time. The authors also found that if patients were scheduled with a return appointment with their primary care physician the numbers increased.³⁶

The role of primary care in improving population health

A greater supply of primary care physicians (as measured by provider-to-population ratios) is associated with better health outcomes. Numerous studies have confirmed that a higher ratio of primary care clinicians is correlated with lower rates of all causes of adult and infant mortality and poor self-reported health status, even when controlling for sociodemographic factors such as age, urban/ruralness, race and ethnicity, education, income, employment status and environmental pollution as well as lifestyle factors such as seatbelt use, obesity, and smoking.^{37, 38,39, 40, 41} In a 1997 study by Starfield and colleagues it was found that an adequate supply of primary care physicians eliminated the adverse affects of income inequality on mortality rates.⁴² A study of cervical cancer mortality rates in Florida found that a one-third increase in the supply of family physicians was associated with a 20% lower mortality rate from cervical cancer.⁴³

A 2003 study of a large national database found that U.S. adults who named a primary care physician rather than a specialist⁴⁴ as their regular source of care had lower subsequent five-year mortality rates, even after controlling for initial differences in health status, health insurance status, demographics and reported diagnoses.⁴⁵ In another study, when urban areas and non-urban areas were examined separately, a greater supply of primary care physicians was found to have a positive effect on mortality rates in non-urban areas.⁴⁶

Further, a 2005 study estimated that an increase of one primary care physician per 10,000 population (an approximate 12% increase over current primary care supply) would result in a 5% decrease in U.S. mortality rates. The authors concluded that as many as 127,617 deaths each year could be averted through an increase in supply of primary care physicians.⁴⁷

It has also been shown that because primary care emphasizes prevention, an increase in the supply of primary care providers in a community results in significant increases in patients' knowledge about the importance of preventive screenings, immunizations and risk factor counseling services.⁴⁸ Another study found that adolescents with a regular source of primary care were more likely to receive preventive care and less likely to seek inappropriate care in emergency rooms.⁴⁹

Cost-effectiveness of primary health care

Perhaps the most compelling recent research about the value of primary care comes from the Dartmouth Atlas Project.⁵⁰ A limitation of the Dartmouth Atlas is its exclusive use of Medicare claims data; a further point worth noting is that Medicare data are the most accessible to the health services research community, despite certain weaknesses in the reported quality of the data. [NOTE: The Maine Health Information Center collects and aggregates all claims data for the states of Maine, Massachusetts, New Hampshire and Vermont, thus allowing much more robust analysis of health care utilization, costs and quality than is available elsewhere in the country, with Colorado being no exception].

A recent report completed by the Dartmouth Atlas team for the Robert Wood Johnson Foundation found that “primary care physicians play a key role in providing and coordinating high quality health care.” Specifically, for chronic conditions such as diabetes and hypertension, primary care physicians have been found to provide comparable care to that provided by specialists in terms of quality and provide it at lower costs. Dartmouth Atlas researchers have found substantial variation across the states among Medicare beneficiaries that had an ambulatory care physician as their predominant primary care provider as opposed to a single or multiple specialists.⁵¹

Interestingly, among the evidence-based reviews included in this study, APNs and PAs were found to have outcomes comparable to physicians practicing in a primary care setting. Often the most positive outcomes are found in the provision of care coordination for chronic care patients with diabetes or hypertension.

Innovations found to improve primary care delivery

A review of the literature of primary health care innovations reveals six models of care that hold significant promise in primary care delivery. Examples of these models are discussed in the evidence-based review studies as well as in the collaborative models of care section of this report.

1. Interdisciplinary team-based approach to primary health care delivery

One of the most studied models in primary care delivery is that of the interdisciplinary team. An interdisciplinary health care team is a deliberately organized team of health care professionals who communicate with one another on a regular basis about the care of a defined group of patients and who jointly participate in the diagnosis and management of patient care.⁵² Collaborating health care teams share five key characteristics: they have clear goals with measurable outcomes, they work within well-defined clinical and administrative systems, the division of labor and competencies is understood by all members of the team, training of all team members in the distinct roles and competencies is well-understood, and all team members engage in effective communication.⁵³ In a variety of settings, research has found that team cohesiveness is associated with effectiveness in carrying out the team’s tasks.^{54, 55, 56, 57, 58}

Recent studies of primary health care practices managing diabetic patients found that better team work between providers was associated with higher quality care for diabetic patients,⁵⁹ better continuity and access to care and higher patient satisfaction.^{60, 61, 62} Practices that used more PAs and NPs in care delivery resulted in lower labor costs per visit, although some of these studies have been criticized for not fully accounting for the fact that non-physician primary care providers see fewer patients per hour and work fewer hours per week than physicians.^{63, 64, 65, 66, 67, 68, 69} Multidisciplinary primary care teams that include physicians, nurses, social workers, psychologists and clinical pharmacists have been found to produce superior clinical outcomes for patients with chronic disease when compared to traditional medical models of care.^{70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81}

2. Open access patient scheduling

Long waiting times for scheduling an appointment that result in delays in care are an ongoing issue in medical care settings and serve as a significant barrier to patients in need of care.⁸² A report issued by the Kaiser Family Foundation that reviewed the data from the Consumers Assessment of Healthcare Providers and Systems (CAHPS) found that 27% of insured adult patients under age 65 reported having difficulty gaining timely access to a clinician.⁸³ Another study reporting on data collected between 1997 and 2001 found that the percentage of patients reporting an inability to schedule a timely appointment rose from 23% to 33%.⁸⁴

The open access model is one in which appointments are not pre-scheduled but rather all appointments are same-day. This model eliminates the need to classify patients as “urgent” or “non-urgent” and frees up nursing staff from responding to triage requests, thus reducing the need to interrupt physician visits for triaging purposes.⁸⁵ The open access model has been found to reap significant efficiency dividends in the form of more satisfied patients, less stressed staff and higher levels of patient-centeredness resulting in greater continuity of care.^{86, 87} In four practices that implemented open access scheduling, providers reduced delays in scheduling preventive visits from 36 to four days.⁸⁸ Another study found that patient visits actually decreased because patients were able to see their primary care provider more often, not less.⁸⁹ It has been further demonstrated that the rate of “no-shows” decreases, avoiding “logjams” created from overbooking appointment slots.⁹⁰ Open access scheduling also has been found to decrease the number of missed appointments for infant and well-child care visits and increase the number of on-schedule childhood immunizations.⁹¹

3. Chronic care model

In the U.S. the majority of patients with chronic conditions such as hypertension, diabetes, tobacco addiction, hyperlipidemia, congestive heart failure, asthma and depression are receiving inadequate chronic care management.^{92, 93,94,95,96,97,98,99} Because the majority of chronic illness care is provided in a primary care setting, chronic care management by interdisciplinary teams of primary health care providers is an important dimension of this study.¹⁰⁰

The chronic care model developed by Ed Wagner has received increasing accolades both in terms of the outcomes achieved and the efficiency and cost-effectiveness of the model. Research has identified six essential components of a successful chronic care model.^{101,102,103} The first four are targeted at the individual practice level and include:

- 1) Providers are encouraged to integrate evidence-based practice guidelines into the care provided to chronic disease patients through reminder systems and increased collaboration with specialists.
- 2) Patients are empowered through self-management support systems.¹⁰⁴
- 3) The delivery system is re-designed in fundamental ways including interdisciplinary teams with a clear division of labor and responsibility that intentionally segregates acute care from planned care management activities.
- 4) Electronic information systems, preferably electronic medical records, are implemented.^{105,106,107}

The final two components occur at the community level. The support of community resources is critical and includes exercise programs, senior centers, self-help groups and local human services agencies. These are especially important resources for small physician practices in rural areas. The structure, goals and values of health care provider organizations must be in line with the reforms embedded in the chronic care model. Without financial and in-kind support from community services and agencies, few incentives exist for physicians to invest their own time and that of their staff in implementing the chronic care model.^{108, 109, 110}

Various studies have found that implementing more than one component of the chronic care model improved physician performance and patient outcomes.^{111,112,113} A diverse range of primary health care practices, ranging from public community health centers to private health care organizations, have implemented the chronic care model and achieved positive patient outcomes.¹¹⁴

4. Collaborative patient partnerships

Research has found that in roughly three-quarters of all primary care appointments when physicians instruct patients to engage in some behavior change such as “change your diet,” “exercise more” or “take your medications,” the instructions were provided with little consultation with the patient.¹¹⁵

Further, physicians' instructions often fail to motivate patients to behavioral change and result in providers labeling some patients as non-compliant with their orders.¹¹⁶

In contrast, the collaborative care model emphasizes active collaboration between patients and primary health care providers as the basis for positive behavior change and compliance with treatment regimens. In this model, both the patient and his provider define the problem and work toward a treatment plan that the patient feels is attainable and in which they can actively engage. By setting collaborative goals through an action plan, patients have a greater opportunity for positive health outcomes than if they simply are provided a plan by their physician.¹¹⁷

Research on the collaborative care model finds that it improves patient outcomes in the treatment and management of asthma, diabetes, arthritis and other chronic conditions.¹¹⁸ It also has been found to increase treatment effectiveness in patients with depression.^{119, 120}

5. Group patient visits

Group visits are an increasingly popular intervention that was designed to increase the effectiveness of chronic care management when patients have similar education and monitoring needs. In group patient visits, histories and problem identification are done in such a way as to not violate HIPAA, including patient privacy. Patients are encouraged to contribute ideas for care management to the group from their own experiences. In one study, diabetic members of a group had their hemoglobin levels fall by 1.3% compared with 0.2% in the control group, and satisfaction with care was higher than among the controls.^{121, 122}

Another form of group visit is the drop-in group medical appointment (DIGMA) which is designed to manage acute problems. DIGMAs improve timely access to care because a provider can see 15-20 patients in 20 minutes. They are also conducive to open access scheduling which was previously discussed.¹²³ Group visits have been found to have a positive impact on patient outcomes such as fewer hospitalizations and emergency department visits, increased patient satisfaction and a decrease in overall costs.^{124, 125, 126}

6. Paperless clinics

At the present time, only a small fraction of U.S. primary care physicians use electronic medical records (EMRs) and an even smaller percentage use e-mail or the Internet to communicate with their patients.¹²⁷ A growing body of research has found that use of EMRs is associated with improved quality of care and patient safety.^{128, 129, 130} In a large-scale cost-benefit analysis of EMR use in primary care offices, it was estimated that the net benefit from using an EMR for a five-year period was \$86,400 per provider. Benefits accrued primarily from savings in prescription-related costs, improved utilization of radiology tests, better and more accurate capturing of charges and decreased billing errors.¹³¹ EMRs can also be linked with public health surveillance which may be critical in bioterrorism emergencies or epidemics.¹³²

Access to primary care in Colorado

One of the primary concerns to be addressed by this study was how collaborative models of care could be deployed to expand access to primary care in Colorado, particularly in the state's medically underserved communities. The literature reviewed for this study and the deliberations of the Advisory Committee point to the potential for non-physician primary health care providers—specifically advance practice nurses, physician assistants and dental hygienists—to expand access through existing collaborative relationships with physicians and other health care providers. Together these interdisciplinary teams can safely provide comprehensive, high quality primary health care. The collaborations discussed in this report include those between non-physician and physician providers as well as primary care physicians and other primary care providers collaborating with and referring

patients to specialists depending on the nature of patient problems which present in a primary care setting.

The maps in Appendix F were developed by Colorado Health Institute (CHI) staff to illustrate the current distribution of primary health care resources around the state. Resources are set in the context of county level population density (Maps 4, 7 and 9) and proportion of households with incomes below 200% of FPL (Maps 3, 6 and 8)—both factors which influence health care supply and demand.

Primary Care Workforce: Evidence and efficacy

PHYSICIAN ASSISTANTS

Physician assistants (PAs) are health care professionals licensed to practice with physician supervision. The PA scope of practice is limited to the provision of medical services that are within the scope of a supervising physician. PAs are trained as primary care providers, although approximately half subsequently serve in a specialty practice.¹³³ The Colorado Medical Practice Act specifies that a physician may delegate authority to a PA to perform acts that constitute the practice of medicine.¹³⁴ PAs have prescriptive authority in all 50 states, including prescribing controlled substances.¹³⁵

Licensure

To become licensed as a PA in Colorado the applicant must:

- Graduate from an accredited PA program;
- Successfully pass the national certifying exam of the National Commission on Certification of Physician Assistants (NCCPA); and,¹³⁶
- Be at least 21 years of age.

Renewal requirements to maintain a valid license include renewing every two years and completing a mandatory license renewal questionnaire. Colorado PAs are not required to hold current NCCPA certification to obtain or renew their license.

The Colorado Board of Medical Examiners established Rule 400 that recognizes three levels of PA practice. Each level has its own supervision requirements.¹³⁷

1. New Graduate
 - The PA has recently graduated from an accredited PA program, is licensed and has been employed for six months or less as a PA with fewer than 500 patient encounters.
 - On-site supervision is required for the first 1,000 hours of patient care contact and all charts must be reviewed and signed within seven days by a supervising physician.
 - A performance assessment must be completed by the primary supervising physician at the end of six months, then quarterly for the first two years of practice and twice a year thereafter.
2. New to a Practice
 - The PA is new to a practice but has worked as a PA for at least the two-year period required of new graduates.
 - On-site supervision is not required but the PA must have an adequate means for communication with a supervising physician (primary or secondary) by telephone, radio, pager or other telecommunication device.
 - A performance assessment must be completed by the primary supervising physician at the end of six months and twice a year thereafter.

3. All Others

- There is no requirement for charts to be signed or on-site supervision as long as a PA has adequate means for communication with a physician supervisor (primary or secondary) by telephone, radio, pager or other telecommunication device.
- A performance assessment must be completed by the primary supervising physician twice a year.

Accreditation and certification

After graduating from an approved program, PAs must pass the Physician Assistant National Certifying Examination (PANCE), a multiple-choice test comprising 360 questions that assess basic medical and surgical knowledge. State licensure is not required to apply for national certification, although passing the PANCE is typically a requirement for state licensure.

Training and education

PA education programs are approved by the Accreditation Review Commission on Education for Physician Assistants (ARC-PA). The American Academy of Family Physicians, the American Academy of Pediatrics, the American Academy of Physician Assistants, the American College of Physicians, the American College of Surgeons, the American Medical Association and the Association of Physician Assistant Programs cooperate with the ARC-PA to establish, maintain and promote appropriate standards of quality for entry-level education of PAs. These bodies also recognize the educational programs that meet the minimum requirements outlined in *Accreditation Standards for Physician Assistant Education, Third Edition*.

The average program is 26 months in length and the curriculum is based on the medical model with approximately one year of didactic curriculum that “must be of sufficient breadth and depth to prepare the student for the clinical practice of medicine.” The didactic curriculum includes instruction in basic sciences (including pharmacology and pharmatherapeutics), clinical preparatory sciences, behavioral and social sciences, medical literacy (the ability to evaluate medical literature), health policy and professional practice.^{138, 139}

The didactic curriculum is followed by 12-14 months of supervised clinical practice including rotations in internal medicine, family medicine, surgery, pediatrics, obstetrics and gynecology, emergency medicine and geriatric medicine. The didactic curriculum and rotations are an intense shortened version of what occurs in medical school. Applicants to PA programs have a bachelor’s degree and an average of four years of health care experience as most programs require previous health care experience and a college degree. A central difference between PA education and physician education is the time spent in a university-based educational program. Medical students are required to do a one-year, post-graduation internship. A majority of medical school graduates also complete a residency program in a specialty field.

PAs are not required to complete an internship or a residency program, although in Colorado new graduates are required to practice under the supervision of a licensed physician for the first 1,000 hours of direct patient care and have their charts signed by their supervising physician.¹⁴⁰ According to the 2008 American Academy of Physician Assistants (AAPA) Physician Assistant Census survey, 40% of PAs obtained a bachelor’s degree and 43% completed a master’s degree.¹⁴¹ Ohio and Mississippi mandate that PAs complete a master’s or higher degree to practice.¹⁴² [NOTE: A comparison of education and certification requirements between PAs and physicians is included in Appendix G: Primary Care Professions Matrix]

Supervision and collaboration

In Colorado, PAs must be supervised by a licensed physician following the Colorado State Board of Medical Examiners (BME) rules and regulations for the licensure and practice of physician assistants which includes legal liability for the patient care rendered by PAs.¹⁴³ All prescriptions written by PAs must carry the name of a supervising physician. Supervision can occur without the physical presence of a physician when the delegated medical functions are carried out per BME regulations or when the clinic is located in a designated health manpower shortage area.¹⁴⁴

Physician Assistants: Evidence from the Literature Review

The literature search identified a total of 430 articles. From these articles, 27 qualified for a full article review and nine studies were considered to have sufficient evidence to be included in the report. Three of the nine articles were also included in the APN review where PAs were included in the study design.

All of the studies were observational. Five articles grouped PAs with NPs together and assessed quality, outcomes and/or processes of care relative to that provided by physicians. The heterogeneity of the studies limited our ability to present a set of findings across the studies related to specific aspects of quality, outcomes or efficacy.

PA studies generally occurred prior to 1980, when the profession was young and resulted in an emerging literature as evidenced in the studies identified through the literature search tools. PAs practice under state medical practice acts and as such have a statutorily defined relationship with a supervising physician; thus, controlled experiments concerning scope of practice are less frequent than for other non-physician primary care providers such as NPs and certified nurse-midwives (CNMs) who function under a separate practice act.

Quality of care

The quality of care in the studies reviewed was found to be comparable between PAs, NPs and physicians, particularly with regard to diabetic care. Other differences, however, were noted between NPs and PAs.^{145,146} For example, an analysis of data from the National Ambulatory Medical Care Survey (NAMCS) for the period between 1997 and 2002 found a significantly larger proportion of NPs practicing in primary care settings when compared to PAs (60% vs. 31%). Another study found that PAs were more likely than NPs to work in a community health center. Still another study found NPs were significantly more likely to assess HbA1c and lipid levels in their diabetic patients than PAs (80% vs. 58%) and that these assessment rates were similar to those of physicians.¹⁴⁷

Processes of care

The process of care outcomes most often studied included prescribing, referrals and practice patterns. One study found that a large majority of PAs appropriately were referring their patients to a physician for follow-up care—79% referred up to 10 patients a week to their supervising physician and 75% referred a similar number of patients to a non-supervising consulting physician each week.¹⁴⁸ In the analysis of NAMCS data, researchers found that PAs practicing in a rural area prescribed fewer medications than those practicing in an urban area as well as fewer than NPs and physicians practicing in rural areas. The mean number of medications recorded per visit was similar across all provider types. PAs and NPs at tertiary hospitals in Ohio and Pennsylvania included in one study were more likely to include a patient's social history in admission notes than physicians to whom they were being compared.

Patient satisfaction

Only one study analyzed patient satisfaction within a closed panel model HMO. An 8-item questionnaire was administered to patients to assess satisfaction with their primary care provider type and no statistical differences were found between physician and non-physician providers.

Access to care

Two of the studies reviewed discussed dimensions of access where type of payment was found to increase the likelihood of utilizing a PA or NP with the exception of payments within an HMO that increased the likelihood of utilizing a physician. Practicing in a rural setting had a significant and positive impact on the use of PAs and NPs for a primary care visit, but the study was conducted in a hospital outpatient clinic, thus limiting the application of the study's findings to other care settings.¹⁴⁹ In a study undertaken in California and Washington, PAs were significantly more likely than physicians to work in a rural area, including health professional shortage areas (HPSAs). PAs were also more likely to provide care to vulnerable populations.¹⁵⁰

In general, the studies reviewed found no significant differences in patient outcomes or satisfaction with the care provided by PAs as opposed to physicians.

ADVANCED PRACTICE NURSES

Advanced practice nurse (APN) is an umbrella term that includes nurse practitioners (NPs), certified nurse-midwives (CNMs), certified registered nurse anesthetists (CRNAs) and clinical nurse specialists (CNS). NPs make up the largest group of APNs¹⁵¹ and are more likely to practice in primary care settings than PAs (90% vs. 50%).^{152,153} They also are the most common non-physician health care providers practicing in primary care settings; increasingly, NPs are the initial point of contact in primary care, often functioning as a member of an interdisciplinary health care team or in a medical home setting with access to a collaborating physician.^{154,155}

Nurse Practitioners (NPs)

Licensure

To become licensed as an NP in Colorado the applicant must:

- Possess an active, unencumbered Colorado or multi-state compact professional nurse (RN) license; and,
- Have graduated from an approved NP graduate or post-graduate program.

Accreditation and certification

To have prescriptive authority, NPs are required to obtain a minimum of 1,800 clinical hours and establish a collaborating relationship with a licensed physician. Colorado is one of eight states that do not require national certification to practice as an NP. Of the 10 states that allow NPs to practice without physician involvement, nine require national certification through the American Nurses Credentialing Center (ANCC).

To become certified as an NP an applicant must:

- Hold an active RN license;
- Complete a master's degree or doctorate in a specialty area that is accredited by the Commission on Collegiate Nursing Education (CCNE) or the National League for Nursing Accrediting Commission (NLNAC). A pediatric nurse practitioner may sit for the Primary Care Certified Pediatric Nurse Practitioner Exam (CPNP-PC) through the Pediatric Nursing Certification Board (PNCB);
- Complete a minimum of 500 faculty-supervised clinical hours in the chosen specialty area; and,

- The graduate program must include didactic content in advanced health assessment, advanced pharmacology; advanced pathophysiology; health promotion and disease prevention, differential diagnosis and disease management.

All educational requirements must be completed prior to sitting for the qualifying examination for certification. Re-certification occurs every five years through the ANCC and every seven years through the PNCB. Renewal requirements in the five professional development categories will change in 2009.¹⁵⁶

State licensure must be renewed every two years. Those APNs with an active license must file the appropriate forms through the Colorado Department of Regulatory Agencies (DORA). If an APN's license has been inactive or expired for more than two years, the individual must then demonstrate competency through approved re-licensure procedures.

Training and education

As of July 1, 2008, NPs in Colorado are required to obtain a master's degree in their chosen specialty. In 2004, the American Association of Colleges of Nursing (AACN) strongly encouraged its member colleges that offer advanced degrees to also offer a doctorate of nursing degree. A target date of 2015 was established. The University of Colorado School of Nursing has a doctorate in nursing degree and was the first nursing program in the country to offer a master's degree in 1965.¹⁵⁷ [NOTE: A comparison of education and certification requirements between NPs and physicians is included in Appendix G: Primary Care Professions Matrix]

Supervision and collaboration

In Colorado, a collaborative relationship with a physician is required for prescriptive authority. This relationship is established through a written collaborative agreement that specifies the physician's and APN's duties and responsibilities. The agreement includes provisions regarding consultation and referrals and an APN-designed protocol to ensure that appropriate prescription practices are followed. Other than prescriptive authority, APNs are licensed to practice independently within their scope of practice under the Nurse Practice Act and are reimbursed directly as primary care providers by public and private third-party payers.

Certified Nurse-Midwives (CNMs)

CNMs are RNs who have completed an accredited program of study and clinical experience in obstetrical care. As defined by the American College of Nurse-Midwives (ACNM), midwifery is the "independent management of women's health care, with a particular focus on pregnancy, childbirth, the post-partum period, care of the newborn and the family planning and gynecologic needs of women."¹⁵⁸ CNMs deliver babies, provide gynecologic care including family planning, provide prenatal and postnatal care and co-manage high-risk pregnancies with a physician.¹⁵⁹ In Colorado, CNMs attend approximately 10% of all births. Third-party reimbursement of CNMs is mandated in Colorado.¹⁶⁰

CNMs, through the American College of Nurse Midwives (ACNM), and physicians specializing in obstetrics and gynecology through the American College of Obstetrics and Gynecology (ACOG), have agreed to a joint statement of practice relations that affirms "their commitment to promote appropriate standards for education and certification of their respective members, to support appropriate practice guidelines, and to facilitate communication and collegial relationships between obstetrician-gynecologists and certified nurse-midwives/certified midwives."¹⁶¹ This joint statement is emblematic of the level of mutual respect and trust the two professions hold for each other and their commitment to high quality and the safe care for women.

Licensure

To become licensed as a CNM in Colorado the applicant must:

- Possess an active, unencumbered Colorado or multi-state compact professional nurse (RN) license; and,
- Meet the standards for education and certification established by the ACNM, American Midwifery Certification Board (AMCB), formerly known as the ACNM Certification Council (ACC).

Accreditation and certification

CNMs are certified by the AMCB. To become certified, a CNM must:

- Hold an active Colorado RN license;
- Graduate from a nurse-midwife education program that has been accredited by ACNM Division of Accreditation; and,
- Complete one-year of post-graduate clinical training.

CNMs have been certified since 1977 and are licensed in all 50 states. CNMs certified before January 1996 do not have a time limitation on their certification. CNMs certified after January 1996 must renew their certification every eight years by demonstrating certification maintenance as determined by the AMCB.¹⁶² Like other APNs, CNMs must renew their state license every two years but also maintain their accreditation by complying with the AMCB Certificate Maintenance Program (CMP) requirements.

Training and education

Typically, CNM training programs build on a bachelor of science in nursing (BSN) degree and are 24 months in duration, with one year spent in clinical training. CNM clinical training must include hospital experience and sufficient pregnancy management experience.¹⁶³ CNMs are required to have a professional nursing (RN) background. Although continuing education is not required to maintain certification, the AMCB recommends that CNMs participate in the Continuing Competency Assessment Program.¹⁶⁴ By 2010, a graduate degree will be required nationally to practice nurse-midwifery.¹⁶⁵ [NOTE: A comparison of education and certification requirements between CNMs and OB/GYNs is included in Appendix G: Primary Care Professions Matrix.]

Supervision and collaboration

CNMs seek consultation, collaborative management and/or referrals with a physician depending on the risk level and health status of their patients. CNMs often seek advice from other members of the health care team, most often from obstetricians or other consulting physicians familiar with a patient and her status. Such consultations are noted in a patient's medical record. CNMs and physicians may jointly manage the care of a woman who has become high risk. If a physician assumes the primary role in the care of a high-risk woman, the CNM may continue to participate as a counselor and coach offering guidance and support. All medication orders written by CNMs without prescriptive authority must be co-signed by a physician or another APN with prescriptive authority.¹⁶⁶

Certified Registered Nurse Anesthetists (CRNAs)

CRNAs are APNs who have received specialized training to administer anesthesia. For over 100 years, CRNAs have administered anesthesia, currently CRNAs administer anesthesia to approximately 30 million patients each year. Nationally, CRNAs are the primary providers of anesthesia in rural areas, permitting these otherwise medically underserved areas to offer obstetrical, surgical and trauma stabilization services.^{167,168,169,170,171} Of the anesthesia care provided in rural hospitals, 70% is provided by CRNAs. Nationally, approximately 37% of nurse anesthetists practice in towns with populations of less than 50,000.¹⁷²

Licensure

To become licensed as a CRNA in Colorado the applicant must:

- Possess an active, unencumbered Colorado or multi-state compact professional nurse (RN) license; and
- Pass the national certification examination administered by the Council on Certification of Nurse Anesthetists (CCNA).

As with other APNs in Colorado, licensure renewal occurs every two years. Recertification by the CCNA also occurs every two years.

Accreditation and certification

CRNAs are certified by the American Association of Nurse Anesthetists (AANA) Council on Certification. CRNAs are eligible for certification upon completion of a nurse anesthesia educational program accredited by the Council on Accreditation of Nurse Anesthesia Educational Programs (COA).¹⁷³ In Colorado, CRNAs are required to hold an active RN license. Certification is valid for two years and then it must be renewed. To renew, a CRNA must complete the following:

- A minimum of 40 credits of approved continuing education;
- Documentation of a minimum of 850 hours of anesthesia practice over a two-year period; and,
- Certification that the CRNA has not developed any medical conditions that could adversely affect his/her ability to administer anesthesia.¹⁷⁴

Medicare requires CRNAs be actively certified in order to receive direct reimbursement.¹⁷⁵

Training and education

Before admission into an accredited CRNA program, an individual must hold an active RN license and have at least one year of acute care experience. Typically, programs are 24-36 months in duration with one year focusing on clinical work. A minimum number of 550 anesthesia cases are required by COA standards prior to sitting for the certification exam. Data from the 2006 national certification exam found CRNAs averaged 1,748 case hours during residency training and prior to sitting for the exam. CRNAs are trained to administer both general and regional anesthesia, select local and conscious sedation, monitor anesthesia administration and administer anesthesia for pain management. CRNAs are certified to treat patients of all ages and from simple to complex cases.¹⁷⁶ [NOTE: A comparison of education and certification requirements between CRNAs and anesthesiologists is included in Appendix G: Primary Care Professions Matrix]

Supervision and collaboration

In Colorado, the administration of anesthesia by CRNAs is within the scope of practice of a CRNA practicing as a registered advance practice nurse under the authority of the Nurse Practice Act. Further, the Colorado Board of Health eliminated the requirement for CRNAs to be supervised in a hospital or outpatient surgery center when administering general or regional anesthesia.¹⁷⁷

In November 2001, the Centers for Medicare & Medicaid Services (CMS) published a final rule in the *Federal Register* amending a previous requirement that all CRNAs must be supervised by a physician. The new rule permitted states to “opt-out” of the federal supervision requirement and allow CRNAs to provide anesthesia without the direct supervision of a physician. The *Federal Register* noted that “...in the absence of clear research evidence it is impossible to definitively document outcomes related to independent CRNA practice.”¹⁷⁸ The Agency for Healthcare Research and Quality (AHRQ) agreed to conduct a study of anesthesia outcomes in those states that chose to opt-out of the CRNA supervision

requirement and compare them to states that did not. The study, however, was not conducted due to a lack of funding.¹⁷⁹

For a state to opt-out, the governor must submit a letter of testimony to CMS. The letter must state that the governor has consulted with the state's Board of Medicine and Board of Nursing with regard to access to anesthesia services. In addition, the letter must reflect that opting out of the supervision requirement is in the best interest of the state and is consistent with state law. A request to opt-out becomes effective upon submission.¹⁸⁰

Iowa was the first state to opt-out of the direct supervision requirement in December 2001. At the time of this opt-out CRNAs in Iowa were the exclusive providers of anesthesia services in 91 of the state's 118 acute care hospitals. Thirteen other states have opted out since the rule change took effect. Interestingly, Montana originally opted out in 2004 under Governor Judy Martz and then in 2005, Governor Brian Schweitzer reversed the opt-out without apparent evidence to explain his decision. One month later, after reviewing the reasoning for the original opt-out, Governor Schweitzer restored the opt-out in Montana.¹⁸¹

| Year of Opt-Out | States |
|-----------------|--------------------|
| 2001 | IA |
| 2002 | NE, ID, MN, NH, NM |
| 2003 | KA, ND, WA, AK, OR |
| 2004 | MT |
| 2005 | SD, WI |

In 2003, Colorado Governor Owens notified the Board of Medicine and the Board of Nursing that he was considering removing the federal CRNA supervision requirement for Medicare reimbursement.¹⁸² Soon thereafter, a lawsuit was filed by the Colorado Society of Anesthesiologists stating that an opt-out would violate the various state laws and regulations. As a result, the governor reversed his decision to implement the federal opt-out provision. At the same time, the governor urged the Board of Health to remove regulations that require physician supervision of CRNAs. At a hearing in May 2003, the Board of Health decided by a 5-1 vote to adopt the proposed rule change removing the requirement for physician supervision of CRNAs.¹⁸³

Proponents of the opt-out argued that physicians are hesitant to work in Colorado's rural hospitals since they may be required to sign off on CRNA charts and the physician will be listed by the hospital as the supervisor of anesthesia services. Non-anesthesiologist physicians often have expressed not feeling competent to review the treatment of a CRNA because they have not had an equal level of training in anesthesia care. In addition, many rural hospitals are not able to recruit and financially support an anesthesiologist. Opponents argue that supervision is the safest approach to CRNA practice and that the supervision requirement has been in force for over 40 years.^{184, 185}

The National Rural Health Association and the Colorado Rural Health Center have expressed support for an opt-out of the physician supervision requirement in Colorado to make certain that anesthesia services are available in rural areas. It is currently estimated that CRNAs provide 70% of the anesthesia care in rural U.S. counties¹⁸⁶ CHI has mapped Colorado's rural hospitals and the known anesthesia staffing at these hospitals based on the current staffing configuration at each hospital [See below].

When states opt-out, individual facilities maintain their authority to require supervision by an anesthesiologist or other licensed physician with staff privileges. In sum, hospitals can continue to require physician supervision by so stating in their bylaws.

Advanced Practice Nurses: Evidence from the Literature Review

The literature search returned a total of 1,116 articles—778 related to NPs, 191 related to CNMs and 147 related to CRNAs. From these articles, 122 qualified for a full article review which produced 17 studies that met the criteria to produce an evidence basis. Twelve studies were specific to NP practice, four to CNM practice and three to CRNAs. Two of the studies examined both NP and CNM practice in a community setting.

Twelve studies took place in a primary care setting and five in a hospital setting. One intervention occurred in Colorado, while two of the three systematic reviews were conducted in the United Kingdom, all of which contained studies conducted in the U.S. Ten studies dealt exclusively with an adult population, four included a pediatric population and in the three meta-analyses, the patient populations were not specifically discussed. One systematic review focused on the quality of care provided by NPs and CNMs relative to physician care. Three studies were randomized case-control studies that compared the outcomes associated with NP care versus that of physicians. There was sufficient heterogeneity between the studies that a common and/or consistent set of findings with regard to processes and quality of care did not emerge from the evidence-based review.

Quality of care

Consistent with earlier systematic reviews of APNs, the two meta-analyses reviewed by CHI staff found that NPs deliver comparable quality of care to that provided by physicians with regard to the outcomes measured. One of the studies reviewed in the first meta-analysis examining the role NPs and NMs in primary care included studies related to NP/NM* teams, NP/physician teams and NM/physician teams practicing in primary care settings.¹⁸⁷

The Horrocks (2002) systematic review included studies that compared NPs and physicians providing first point of contact care in primary care settings. The models of care were not specifically referenced in the review but rather various outcomes were compared between the two types of practitioners.¹⁸⁸ In general, this meta-analysis included evaluations of APNs functioning either as members of an interdisciplinary health care team or in a collaborative relationship with a physician or other primary care professionals.^{189,190}

In one study (Ohman-Strickland, 2008), the research design specifically looked at family medicine practices that employed NPs, PAs or neither and compared outcomes across the various types of practices including physician-only practices. Two studies focused specifically on diabetic patients where NPs were found to be more likely to monitor HbA1c and lipid levels than physicians. In one study, diabetic patients who were managed by a NP/physician team demonstrated significant improvements in long-term diabetes control reflected in decreased HbA1c levels.

- 66% of NPs assessed HbA1c levels compared to 49% of physicians; and
- 80% of NPs assessed lipid levels compared to 68% of physicians.

In the studies that met the evidence-based review criteria, nurse-midwives and CRNAs had equivalent quality of care when compared to physicians. Study design and data limitations did not allow for

* In this meta-analysis, the term “certified nurse-midwife (CNM)” was not used; instead, the authors referred to studies involving “nurse midwives (NM).”

generalizations of comparative quality between physicians and APNs, particularly with regard to specific populations such as older adults at one end of the age continuum and children at the other end.

Process of care

Process of care outcomes included in the studies reviewed were: time spent with patients, prescribing practices and frequency of ordering of diagnostic tests. NPs were found to spend more time with patients, averaging 11.57 minutes compared to physicians who spent an average of 7.28 minutes per patient. The researchers did not report productivity measures.¹⁹¹ In the Venning et al. (2000) study, no significant differences were found in prescribing practices of NPs and physicians, but NPs ordered more tests than physicians and were significantly more likely to schedule a follow-up visit.¹⁹² In the Litaker study, NPs scored higher on measures of providing preventive care and patient education than physicians.¹⁹³ The Brown and Grimes (1995) meta-analysis found that in low-risk births attended by CNMs, women received less analgesia, anesthesia and fetal monitoring and fewer episiotomies, forceps deliveries and intravenous fluids. There were no studies that specifically measured processes of care for CRNAs versus anesthesiologists. In the studies where relative costs were discussed, when practicing alone APNs cost less, but when practicing on a team costs were higher than physicians practicing alone.¹⁹⁴

Patient satisfaction

Health service utilization and patient surveys were used to measure satisfaction in nine studies. Patient satisfaction was consistently and significantly higher for NPs, especially when measuring satisfaction with patient education and treatment plans. CNMs received higher satisfaction ratings than obstetricians.¹⁹⁵ In general, the studies reviewed found higher levels of patient satisfaction with NPs and higher satisfaction ratings for patient education provided by NPs. NPs were found to spend more time with their patients, which was hypothesized to explain, in part, the higher patient satisfaction scores they achieved. There were no studies measuring satisfaction with care and services provided by CRNAs versus anesthesiologists.

Access to care

Four studies discussed access to primary care but due to the heterogeneity of settings in the studies reviewed, they could not be directly compared or similar conclusions drawn. One urban-based study found access to prenatal care for indigent women was increased when compared to a non-intervention group (52.5% vs. 44.6%).¹⁹⁶ Another study comparing primary care physicians and non-physician primary care providers in California and Washington found that a greater proportion of NPs and CNMs in California worked in a rural area or HPSA compared to physicians. These non-physician primary care providers also served a greater proportion of Medicaid, uninsured and minority patients in their practices than the physicians included in the study.¹⁹⁷ Like Colorado, California requires a collaborative agreement for prescriptive authority between an APN and physician. A study comparing CRNA-only hospitals with anesthesiologist-only hospitals found that CRNAs served a greater percentage of Medicaid patients than anesthesiologists (43% vs. 30%).¹⁹⁸

DENTAL HYGIENISTS

In primary oral health care delivery, the role of the dental hygienist is to prevent disease and promote oral health wellness.¹⁹⁹ The Colorado Dental Practice Act (2007) defines dental hygiene to be:

“...the delivery of preventive, educational and clinical services supporting total health for the control of oral disease and the promotion of oral health provided by a dental hygienist within the scope of his or her education, training and experience and in accordance with applicable law.”

Colorado's scope of practice for dental hygienists is relatively permissive compared to most other states. Colorado and Maine²⁰⁰ are the only two states that allow dental hygienists to practice without supervision. Colorado's practice act explicitly states that dental hygienists can be "the proprietor of a place where supervised or unsupervised dental hygiene is performed and may purchase, own or lease equipment necessary to perform supervised or unsupervised dental hygiene."²⁰¹

Licensure

To become licensed as a dental hygienist in Colorado an applicant must:

- Graduate from an accredited dental hygiene program of at least two academic years in length;
- Pass the national board examination;
- Pass a regional or state board clinical examination; and,
- Pass the state board licensure examination.
- Dental hygienists must renew their license every two years.

Accreditation and certification

Dental hygienist certification is less standardized than that of the other health care professionals included in this study. National certification is granted by the American Dental Association (ADA) when an applicant receives a 75% or higher score on the National Dental Hygiene Board Examination.²⁰²

Training and education

The Commission on Dental Accreditation of the ADA is responsible for accrediting dental hygiene education programs with approximately 270 commission-accredited dental hygiene programs in the United States. Dental hygienists are trained to provide direct patient care including examining the teeth and gums, teeth cleaning and applying fluorides and sealants.²⁰³ Colorado does not mandate any additional education for a dental hygienist to practice unsupervised dental hygiene as defined in the Dental Practice Law. Colorado is the only state that does not require Continuing Medical Education (CME) for dentists or dental hygienists.

Two types of academic programs are available to train dental hygienists. After completing the necessary prerequisites to enter a dental hygienist program, option one is to pursue a 4-year baccalaureate degree and option two is to pursue a 2-year program and receive a certificate of completion. The 4-year program contains non-clinical academic coursework for the first 2 years with and the last 2 years focus on the accreditation standards for dental hygiene programs. The 2-year dental hygiene program focuses on the accreditation standards developed for the certificate option. There is little difference in the 2-year clinical education and training between the two academic programs as they both are required to meet the ADA Council on Accreditation Guidelines. [NOTE: A comparison of education and certification requirements between dental hygienists and dentists is included in Appendix G: Primary Care Professions Matrix]

Supervision and collaboration

Dental hygienists in Colorado may practice at three different levels of supervision: 1) under the direct supervision of a dentist with a dentist physically present in the practice; 2) indirect supervision where a dentist does not need to be physically present; and 3) unsupervised where the dental hygienist practices independent of a dentist.

Unsupervised licensed dental hygienists in Colorado may administer prophylaxis treatments, topical anesthesia, fluoride, Pit/fissure sealants and place perio-dressings. Other states allow dental hygienists to administer these same treatments without supervision but require additional education, including a residency requirement (e.g., California). Dental hygienists in Colorado are not permitted to provide a diagnosis to patients from x-rays or other clinical findings even though they receive education and

training in the identification of caries and other oral health conditions. Legislation has been proposed that will allow dental hygienists to diagnose an oral health condition as well as administer local anesthetic under all levels of supervision; the status of the legislation is unknown at this time. The primary intention of the bill is to provide for more open and full communication between dental hygienists, patients and dentists.

Dental Hygienists: Evidence from the Literature Review

The literature search returned a total of 410 articles of which 30 qualified for a full article review. The full article review produced five articles that were included in the evidence-based findings.²⁰⁴ All five of these articles received a fair rating by CHI reviewers. Three of the five articles reported on the same study, but reported on different aspects of the study findings: quality of care, patient satisfaction and patient demographics.

The *Health Manpower Pilot Project* conducted in California in 1987 was the first study of its kind to evaluate the quality of independently practicing dental hygienists under statutory pilot authority granted by the California Legislature which specified that prior to making changes in health personnel licensure, pilots should be conducted to produce an evidence basis for recommended changes. Although Colorado allowed the independent practice of dental hygienists and Washington permitted such practice in institutional settings in 1987, no studies had been conducted to assess the impacts on access or the quality of care provided by independently practicing dental hygienists. It was consistently noted that evidenced-based research about the independent practice of dental hygiene was negligible prior to this study.

Quality of care

The California study compared the quality of care provided by dentists in six dental practices and in nine independent dental hygienist practices by randomly selecting and reviewing, through chart audits and 225 patient records, the quality of care provided.²⁰⁵ Dental hygienists outperformed dentists on several quality indicators including appropriate follow-up to medical concerns, maintaining complete and up-to-date patient medical and oral health histories and administration of radiographs. In summary, the demonstration project found no differences in quality of care although it was forced to end the project prematurely because of a lawsuit brought by the California Dental Association.²⁰⁶

A second parallel study conducted in Colorado found the quality of care to be at least equivalent and at times better than that provided by dentists in the areas of completeness of medical histories, appropriateness of recorded patients' caries status, recorded soft-tissue findings and periodontal status.

Specific findings included:

- 77% of dental hygienists had acceptable follow-up to medical conditions reported by their patients compared to 17% of dentists;
- 91% of hygienists had an acceptable up-to-date medical and oral history for their patients at visit recall compared to 42% of dentists;
- 89% of hygienists had acceptable bitewing radiographs, 100% had acceptable periapical films and 95% had acceptable frequency of processing film compared to 68%, 92% and 79% of dentists respectively.²⁰⁷

The evidence from these studies found that independently practicing dental hygienists were able to competently provide dental hygiene services within their scope of practice based on their education and training. The studies also found that independently practicing hygienists increased patient referrals to the dentist and had better patient follow-up rates.

Patient satisfaction

The vast majority of patients being seen by a dental hygienist in the studies reviewed were satisfied with the care they received, found their hygienists' examinations to be thorough and were satisfied with the fees charged. Specific findings included:

- 98% of patients were satisfied with the care provided by their DH;
- 90% agreed with that the care provided was thorough and appropriate ; and
- 96% agreed that their hygienist was “very careful to check everything when examining.”

Collaborative Models of Primary Care Delivery

In Governor Ritter’s executive order, he noted that “it is clear from health manpower studies that we do not have sufficient numbers of providers, especially physicians and dentists, to meet the current [health care] needs of Coloradans. This problem is especially acute in rural and other underserved areas.” Further, he called for a research group to “undertake a study of scopes of practices for advanced practice nurses, physician assistants and dental hygienists in terms of the services that are delivered, the settings in which those services are delivered and the quality of care provided.”

This section of the report discusses the peer-reviewed and “gray literature” comprising reports, studies and activities underway to address issues of competencies, unmet need among vulnerable populations and public health and safety issues related to non-physician, non-dentist primary care health professionals. It is organized to specifically discuss issues of efficacy, quality and patient satisfaction with models of primary care delivery that utilize allied health professionals as members of a collaborative health care team whose goal it is to provide comprehensive primary care across discipline boundaries. In particular, it examines:

- Evidence of increased access, particularly in rural and other underserved areas through the use of collaborative primary care teams;
- Use of NPs, PAs and dental hygienists in public and nonprofit settings such as community and migrant health centers, school-based health centers and Rural Health Clinics;
- Core competencies of non-physician and non-dentist primary care professionals engaged as members of an interdisciplinary primary care team;
- Evidence of barriers associated with collaborative models of care involving NPs, PAs, CNMs, dental hygienists, physicians and dentists;
- Evidence of adverse impacts in the use of PAs, NPs and DHs created by reimbursement policies;
- Emerging allied dental workforce models;
- Use of non-physician primary care providers in fully capitated HMOs versus other forms of reimbursement;
- Cost-effectiveness of non-physician and non-dentist primary care providers;
- The content of primary care and core competencies associated with its provision; and
- Population characteristics associated with use of non-physician/non-dentist providers.

EXAMINING COLLABORATIVE MODELS IN PRIMARY HEALTH CARE SETTINGS

From the evidence-based review findings, APNs have been shown to be competent primary care clinicians and effective communicators, spending additional time to discuss prevention and treatment regimens with patients to achieve better compliance and treatment outcomes, particularly among patients with chronic health conditions. When considering the range of collaborative models of care, APNs often function in the role of health care consultant and care manager to assess health needs based

on a functional assessment as well as physical diagnoses. Research has shown that adding an NP to a physician's office can increase the total number of visits by 40-50 percent.^{208,209}

Although collaboration between various health care professionals has been shown to increase the probability that patients will be treated holistically, using the full resources of an interdisciplinary team, there are many medically underserved areas in Colorado where few or no physicians or dentists are currently practicing.^{210,211,212} Nationally, less than 4% of APNs reported practicing independently in a recent national workforce study (AANP, 2007). Research has found that when APNs practice as part of a multidisciplinary group or within a health care system 75% of adult primary care and 90% of pediatric primary care can be delegated to an NP, with physician support and availability.^{213,214}

[The table include in Appendix H summarizes research studies that were conducted specifically to identify barriers to collaboration between physicians and NPs. It is interesting to note that lack of knowledge about the training and core competencies of APNs and their full legal scope of practice were the most frequently cited barriers to collaboration, followed closely by poor communication.]

Patient-centered medical home

The concept of *medical home* is increasingly mentioned when discussing innovative collaborative models of primary care delivery. Pilot programs are being implemented in Colorado to identify and quantify the components of a medical home, both for adults and children. As noted in the primary care section of this report, the concept of a medical home largely derives from the evolving concept of *primary care*. Perhaps a subtle difference between primary health care and the newly conceived medical home is the same distinction that was noted in 1978 when the WHO contrasted *primary medical care* to *primary health care*, that is, a medical home focuses on access to coordinated care intended to integrate medical and other health care systems with the physician as team leader. Alternatively, the primary *health care team* often identifies a nurse care manager or social worker as team leader depending on the profile of the patients being seen, for example, in the rehabilitation of post-stroke patients, frail elders and special-needs children at high risk for learning disabilities.

Interdisciplinary team practice: Examples from the field

West River Health Services (WRHS)

The West River Health Services encompasses areas of North and South Dakota and eastern Montana, providing primary health care to nearly 35,000 rural residents. WRHS utilizes a critical access hospital (CAH), a central community clinic attached to the CAH and five satellite clinics. Non-physician providers make up 40% of the staff (11 of 27). Providers follow their patients across inpatient and ambulatory care settings. Clinics have electronic access to lab results but since WRHS does not have a full electronic medical record system barriers continue to exist in the efficient transfer of patient records between care settings.²¹⁵

The Northern Colorado Health Alliance (NCHA)

NCHA is a formal collaborative of safety net health care providers serving low-income and underserved populations in Weld and Larimer counties in Colorado. Its mission is to expand access to health care, improve the quality of care provided and eliminate health disparities. NCHA coordinates health care providers and agencies to ensure the full range of individuals' physical, mental and oral health care needs are being met in a patient-centered integrated way. This community-based interdisciplinary approach to treating the whole person includes family physicians and NPs, allied health care professionals, mental health and oral health care providers. The North Range Behavioral Health (NRBH) is co-located with the Monfort Family Children's Clinic and provides both physical and mental health in an integrated setting.

Telehealth and telemedicine

To close the gap that often exists between rural patients and the care they need caused by geographic barriers, telehealth technologies are being implemented in isolated rural areas. Transmitting diagnostic tests such as X-rays and laboratory results and monitoring patients' vital signs are examples of telehealth tools that are increasingly being deployed. Remote practicing NPs or PAs use telemedicine for diagnostic and treatment support.²¹⁶ The Telehealth Network Grant Programs established by the U.S. government seek to help communities build the capacity to develop telehealth networks.²¹⁷

The direct costs of gasoline and indirect costs such as travel time in geographically remote areas often result in delayed care seeking and impact overall treatment effectiveness. These costs can be especially high for patients with chronic conditions who require more frequent visits and on-going monitoring. Telemedicine is one way to bridge the distance between patients and the health care monitoring they require.

Currently several telemedicine programs operate in Colorado:

- The High Plains Telemedicine Network in Fort Morgan
- Poudre Valley Telemedicine Program/High Plains Rural Health Network in Fort Collins
- TeleHealth/TeleEducation Program in Denver
- Centura Health/Colorado Health Network programs in parts of the state
- Community mental health center activities on the Western Slope
- Several Veterans Administration programs across the state.

Colorado requires that physicians have a current Colorado medical license to practice by means of telemedicine, with some exceptions. Two of these exceptions deal with pathology cases, but the most notable exception is the physician-to-physician consultation. This exception allows a patient consultation between a Colorado physician and a physician licensed in another state.

School-based health centers (SBHCs)

SBHCs have been shown to increase the availability of health services to children, largely staffed by NPs and PAs in a school setting.²¹⁸ In most communities where SBHCs are located, local physicians collaborate with NPs and PAs, providing consultation and referral as needed.

Community and migrant health centers (C/MHCs)

C/MHCs historically have recruited non-physician providers to provide a wide range of primary health care services to their patients. A study conducted in 1990 examined differences between 383 rural and urban C/MHCs and found that NPs and CNMs were more likely to be employed at larger C/MHCs that had affiliations with APN and PA training programs. It was also found that rural C/MHCs tended to hire significantly more NPs than physicians.²¹⁹

EXAMINING COLLABORATIVE MODELS IN PRIMARY ORAL HEALTH CARE

Analysis of successful oral health models reveals common elements. These include: 1) involvement of communities in planning and implementation of plans; 2) building upon existing safety net services and infrastructure, linking dental care with other primary care services and 3) changing public or institutional policy to support financing and delivery of dental care.²²⁰

An article by McKinnon et al. describes several emerging oral health care workforce models that have been developed to address some of the shortage issues identified in the 2000 Surgeon General's report on oral health care in the United States, particularly in light of the significant numbers of dentists in the U.S. and in Colorado that will be retiring in the next 10 years.²²¹ The use of these new oral health care

professionals is being seriously examined in a number of states and other countries as well. Tables 1-4 below provide a summary of the core competencies of Advanced Dental Hygiene Practitioners, Dental Health Aide Therapists and Community Dental Health Coordinators.

The American Dental Hygienist Association (ADHA) proposed to establish the Advanced Dental Hygiene Practitioner (ADHP) in 2004 in response to the Surgeon General's Report. The ADHA used advanced practice nursing (APN) as a prototype for developing the ADHP. Similar to APNs, the ADHP model was developed specifically to address unmet health care needs and to act as an oral health care extender. The ADHP would provide diagnostic, prevention, therapeutic and restorative services.²²² [NOTE: The National Association of State Health Policy prepared a useful table of these new oral health care providers which was included in the McKinnon et al. article. It provides a summary of these emerging allied dental professionals and includes a brief description of their education and training, certification/licensure requirements, levels of supervision and scopes of care; see Appendix I - Tables].

Table 2. Advanced Dental Hygiene Practitioner (ADHP) core competency framework

| Domain | General Competencies |
|---------------------------------------|---|
| Provision of primary oral health care | Health promotion and disease prevention, provision of primary care, case management and multidisciplinary collaboration |
| Health policy and advocacy | Health care policy and advocacy |
| Management and oral care delivery | Practice management, quality assurance, leadership and financial management |
| Translational research | Evidence-based practice; problem-solving, critical thinking, and decision making; clinical scholarship and analytical methods for evidence-based practice |
| Professionalism and ethics | Professional behaviors, lifelong learning |

Source: American Dental Hygienists' Association. (2006). Advanced Dental Hygiene Practitioner (ADHP) draft curriculum, June. At: www.adha.org/downloads/ADHP_Draft_Curriculum.pdf.

Table 3. Dental Health Aide Therapist (DHAT) curriculum framework

| Domain | Modules |
|-------------------------|---|
| General health sciences | Anatomy, cell biology, biochemistry, microbiology, and immunology. |
| Oral health sciences | Anatomy and histology, microbiology, oral biology, and oral medicine and oral pathology. |
| Society and health | New Zealand society, Maori oral health, sociology of health and illness, health promotion concepts and principles, health education, the prevention of oral disease in populations, New Zealand health system, allies in health, and quality of oral health care. |
| Clinical Dentistry | New Zealand health system, allies in health and quality of oral health care. Communication skills, dental surgery assisting, cross-infection control, pharmacology, dental diseases and their prevention, dental caries and its clinical management, periodontal disease in children, local analgesia and pain control, radiology, radiography, basic dental materials for dental therapy practice, and introduction to patient management. |

| Domain | Modules |
|-----------------------------|--|
| Advanced clinical dentistry | Dental radiography, operative management of dental caries (amalgam, GIC, composite and stainless steel crowns), dental pain (toothache), differential diagnosis of dental pain, management of deep carious lesions, pulp therapy for the primary dentition, extraction of deciduous teeth, management of traumatic injuries and school dental therapist's role, management of periodontal diseases in children, orthodontic treatment and school dental therapist's role, routine dental care of children with special needs, clinical oral pathology, anomalies of tooth formation and eruption, teenage issues (behavior management and caries), and young permanent dentition (premolars and molars). |
| Dental Therapy Practice | Knowledge of the dental therapy work environment, records (including computer records, work experience and legal requirements to practice dental therapy). Includes four weeks in the District Health Board carrying out dental care under the supervision of a school dental clinic. |

Source: University of Otago Department of Oral Health. Diploma in Dental Therapy. At: www.phs-dental.org/depac/chap/dt_dip.booklet.doc Accessed: November 2008.

Table 4. Community Dental Health Coordinator Curriculum Framework

| Domain | General Competencies |
|--|--|
| Community-based Oral Health Prevention and Promotion | Support fluoridation programs, collaborate and develop community oral health initiatives and programs with other organizations to promote oral health. |
| Collect Diagnostic Data | Competent in medical and dental histories, dental health screening/assessment via visual inspections and radiographs, vital signs and dental charting. |
| Clinical Supportive Treatments | Practice infection and hazard control protocol, prepare tray set-ups, prepare and dismiss patients, apply topical anesthetics, assist/apply fluoride agents, process <u>digital</u> radiographs, provide oral health instruction, maintain patients records, maintain operatory area and dental equipment in <u>community setting</u> , assist with medical and dental emergencies, administer basic life support, and clean removable oral appliances and prostheses in community settings. |
| Administrative Procedures | Collaborate with community partners, maintain supply inventory, control appointments and manage recall system, operate business equipment, complete and process reimbursement papers and facilitate basic legal and regulatory compliance. |

| Domain | General Competencies |
|---|---|
| Priority Population/Patient Groups | Identify potential emergent dental care needs, communicate findings to supervising dentist, revise the screening/assessment based on dentist directive, develop referral recommendation and submit for dentist approval and develop oral preventive recommendation to be approved by dentist. |
| Preventive Services | Provide oral hygiene education, tobacco cessation, dietary counseling, fluoride and sealant application, coronal polishing and scaling for periodontal Type I in community settings. |
| Restorative Services: dental cavity preparation | Hand instruments only, only open cavities that are accessible to hand instruments, manual removal of debris from cavities and placement of temporary materials such as glass ionomer materials. |

Source: American Dental Association (2008) "Community Dental Health Coordinator Curriculum

Another interesting article that looked at overlapping competencies between nursing, medicine and dentistry was found in the *Journal of Dental Education*, Vol 69(11). Table 4 presents the findings from a comprehensive review of health professional core competencies and found a substantial amount of overlap, particularly between medicine and nursing.

Table 5. Overlap in core competencies between dentistry, nursing and medicine

| | | |
|-------------------------------|-----------|-------|
| % Dental competencies in... | Nursing | 38.0% |
| | Medicine | 25.4% |
| % Nursing competencies in ... | Dentistry | 23.4% |
| | Medicine | 18.6% |
| % Medical competencies in... | Dentistry | 50.0% |
| | Nursing | 46.7% |

As is described later in this section, several innovative programs in Colorado, including *Cavity Free at Three*, the *Co-Location Pilot* and the UCD School of Dental Medicine's *Frontier Center* build on the principles of cross-training and collaborative models of care between dentistry, medicine and nursing to extend access and the availability of oral health care services, particularly to vulnerable population groups.

In the area of the unsupervised practice of dental hygienists, a compilation of laws and regulations aimed at self-regulation is listed below for select states and the years in which they passed and implemented such laws and regulations.

Table 6. State legislation in support of the independent practice of dental hygienists

| Policy Goal | State |
|--|--|
| Unsupervised primary oral health care provider | CO (1987); ME (2008) |
| Limited unsupervised practice | CA (1997); CT (1997); MO (2001); MN (2001); NM (1999); OR (1997); WA (1988) |
| Permitting unsupervised practice in institutional settings | CT (1997 and 1999); OR (1997); WA (1988) |
| Facilitate direct payment by third parties and independent contracting | CA; CT (1997); CO (1997); OR (1999); WA (1988) |
| Allowing hygienists to own equipment | MT (1991) |
| General supervision in dental offices | AK; AZ; CA; CT; DE; DC; FL; ID; IA; KS (1998); ME; MA; MI; MN; MO; NE; NC; NH; NM; NY; ND; OH (1998); OR; RI; SD; TN (1998); TX; UT; VT; WA; WI; WY |
| General supervision in institutions | AK; AZ; CA; CT; DE; DC; FL; ID; IA; KS (1998); KY; ME; MA; MI; MN; MO/ NE; NC; NH; NM; NY; ND; OH (1998); OK; OR; RI; SD; TN (1998); TX; UT; VA; VT; WA; WI; WY |
| Administration of local anesthesia/ nitrous oxide | AK; AZ; CA; CT; DE; DC; FL; HI; ID; IL; IA; KY; KS; LA; ME; MA; MI; MN; MS; MO; MT; NE; NV; NH; NJ; ND; OH (1998); OR; PA; RI; SC (2000); SD; TX; UT; VA; VT; WI; WY |
| Removing reference or adding alternative to ADA Commission on Dental Accreditation | CO and IA |
| Creating separate dental hygiene board/practice act | CT (1992 and 1994); NM (1987 and 1994) |

On April 21, 2008, the Minnesota Senate passed an omnibus higher education bill (SF 2942) that included the establishment of a new non-dentist provider, the Oral Health Practitioner (OHP). Originally, the bill was drafted to implement the ADHP model; however, amendments resulted in establishing a workgroup to develop policy recommendations regarding the scope of practice, supervision and education requirements of an OHP. A report is due to the legislature by January 15, 2009. Analogous to ADHP, the purpose of promoting the use of OHPs is to fill an identified gap in access to oral health services in underserved areas of the state. Minnesota law specifically requires that OHPs must practice in orally underserved areas of Minnesota.²²³

Colorado collaborative oral health care models

- *Cavity Free at Three*—an initiative to improve the oral health of pregnant women and their children. Engages safety net providers, physicians, public health agencies, early childhood educators and other community groups to build community systems of care that will increase access to oral disease prevention and early detection services. The goal is to increase the utilization of oral health services by Medicaid children ages 0-2 years to 100% through a train-the-trainer model. *Cavity Free at Three* trains physicians and nurses in oral health exams and the application of fluoride varnishes.

A similar program in North Carolina, *Smart Smiles*, uses primary care providers to screen Medicaid enrolled children for oral health problems and to apply fluoride varnishes and provide oral health education to parents. What started out as a pilot program has been expanded to the entire state and is now called *Into the Mouth of Babes*. Providers participating in the program are eligible for Medicaid reimbursement by attending a training course.²²⁴

- *Frontier Center* at the University of Colorado's School of Dentistry (SOD)—promotes collaborative learning opportunities between medical and dental students and collaborative curriculum development and research between faculty from the University of Colorado School of Medicine and School of Dentistry. A rural dental student track has been developed to parallel that in the School of Medicine.
- Oral Health Care Early Intervention Project, i.e., the *Co-Location Project*—a pilot project is underway to co-locate dental hygienists in six pediatric practices in Colorado and to evaluate the outcomes of the intervention.
- Kids in Need of Dentistry's (KIND) *Chopper Topper* Program is available in a number of Colorado's low-income school districts. Sealants are applied in the school by dental hygienists and follow-up care is provided by the Miles for Smiles mobile dental clinic which is staffed by dentists.

Safety net dental clinics

Dental clinics that operate within a safety net clinic are community-based, located in low-income areas and serve vulnerable populations. Public health departments, community health centers (CHCs), Indian Health Service clinics and other private nonprofit service agencies are all examples of safety net clinics that provide oral health services. The largest two groups of dental safety net providers are federally qualified CHCs and those sponsored by local health departments.

A goal of the Centers for Disease Control's (CDC) Healthy People 2010 is to increase the proportion of CHCs and local health departments that offer dental care. In 2003, \$32 million from federal CHC funds was designated to establish new or expand existing oral health care clinics affiliated with CHCs.²²⁵ The Metro Community Providers Network (MCPN) of Colorado received a \$250,000 Dental Expansion grant from the U.S. Department of Health and Human Services (HHS) through the Bureau of Primary Health Care in 2008 to expand its dental services in a newly built CHC in Aurora. These clinics receive enhanced cost-based reimbursement under the Medicaid program. Due to the infusion of new federal dollars, the volume of dental services provided by CHCs has grown in recent times. By 2006 nearly three-quarters of CHCs nationally provided preventive dental care services.²²⁶

Non-traditional oral health care providers

Physicians and nurse practitioners have been used in several states as providers of oral health care, especially for Medicaid children. Since parents do not typically have their children seen by a dentist before the age of 3, appropriately trained pediatricians, family physicians and nurses can effectively conduct an oral health screening and referral to oral health care providers as needed. These primary care providers also educate parents about good oral hygiene and administer topical fluorides, antimicrobials and sealants.²²⁷ This model is reflected in the *Cavity Free at Three* initiative noted above.

Colorado oral health workforce data

In Colorado we are fortunate to have a number of model initiatives that are testing the efficacy and quality of collaborative oral health delivery, either being conducted on a pilot basis or implemented

through private foundation grants. To illuminate some of the access challenges identified above, findings from two recent surveys of Colorado dentists and dental hygienists are provided.

Reimbursement Policies Related to Non-physician Providers

Reimbursement policies in Colorado’s Medicaid program and the federally administered Medicare program provide for the direct reimbursement of PAs, NPs, CNMs and CRNAs within their defined scopes of practice.

Overview

Reimbursement rates for non-physician primary health care providers usually use the applicable physician fee schedule of a supervising or collaborating physician. Medicaid pays the same amount for the same service regardless of who provides it in a Rural Health Clinic (RHC) or Federally Qualified Health Centers (FQHC) NPs, CNMs and CRNAs can be reimbursed directly under both the Medicare and Medicaid programs. PAs cannot bill independently but can bill under a corporation taxpayer identification number (TIN).

Dental hygienists’ (DH) reimbursement is treated differently. Medicare does not cover preventive dental services and Medicaid does not provide adult benefits so direct reimbursement is not an issue. In the case of Colorado’s Child Health Plan Plus (CHP+) program, the regulations specify coverage for dental services and permit direct reimbursement to dental hygienists. However, Delta Dental of Colorado, which has a contract with the state to administer the CHP+ dental benefit, maintains a policy which does not permit direct reimbursement of dental hygienists.

Medicaid directly reimburses DHs for services provided to children for nine preventive service codes that mirror what is allowed under their scope of practice as “unsupervised services.” Unsupervised DHs may practice independently and bill directly for these services, although those employed by a dentist, clinic or institution cannot bill directly. Medicaid reimburses DHs at 100 percent of the Medicaid dentist fee schedule.

Table 7. Medicaid, CHP+ and Medicare reimbursement policies

| | PAs | NPs | CRNAs | CNMs | DHs |
|---------------------------------|---|---|--|-------------------------------|------------|
| Medicare general | Lesser of actual or 85% of physician fee schedule | Lesser of actual or 85% of physician fee schedule | Lesser of charges or the anesthesiologist fee schedule | 65% of physician fee schedule | No benefit |
| Medicare Surgical 1st assistant | 85% of the physician fee schedule which is paid at 16% of the surgical fee (13.6% of the first surgeon fee) | 85% of the physician fee schedule which is paid at 16% of the surgical fee (13.6% of the first surgeon fee) | | | |

| | PAAs | NPs | CRNAs | CNMs | DHs |
|----------------------------|--|--|--------------------------------|--|--|
| Medicare hospital-based | Lesser of actual or 75% of physician fee schedule | | | | |
| Medicaid | 100% of physician fee schedule | 100% of physician fee schedule | 100% of physician fee schedule | 100% of physician fee schedule | No adult benefit; 100% of dentist fee schedule for defined children's services |
| CHP+ | 100% of physician fee schedule | 100% of physician fee schedule | 100% of physician fee schedule | 100% of physician fee schedule | 100% of dentist fee schedule but not allowed by current administrator |
| RHC Medicare and Medicaid | All inclusive rate per visit. Rate set annually based on cost report. | All inclusive rate per visit. Rate set annually based on cost report. | | All inclusive rate per visit. Rate set annually based on cost report. | No benefit |
| FQHC Medicare and Medicaid | All inclusive rate per visit. Rate set annually based on cost report. Urban and rural payment limit applies for Medicare. Medicaid at 100% cost. | All inclusive rate per visit. Rate set annually based on cost report. Urban and rural payment limit applies for Medicare. Medicaid at 100% cost. | | All inclusive rate per visit. Rate set annually based on cost report. Urban and rural payment limit applies for Medicare. Medicaid at 100% cost. | |

MEDICARE

Medicare is a federally administered program that provides health insurance to 43 million older adults (65+) and permanently disabled adults with a qualifying work history. The Centers for Medicare and Medicaid Services (CMS) administers the program through rules and regulations and contracts with third-party administrators to process Medicare claims.^{228, 229}

Physician Assistants (PAs) and Advanced Practice Nurses (APNs)

Medicare rules require that services provided by PAs and APNs be reimbursed at the lesser of the actual charge or 85 percent of the physician fee schedule (Part B deductible and coinsurance applies)

with the exception of surgical assisting services, services performed in a hospital and outpatient mental health services. PAs and APNs must enroll in the Medicare program and use their National Provider Identifier (NPI) number which alerts the third-party administrator to implement the 15 percent discount.²³⁰

State laws and regulations in the state in which services are provided govern the APNs and PAs scope of practice. PAs and NPs may provide services billed under all CPT evaluation and management codes and diagnostic tests if furnished under a collaborative agreement with (in the case of APNs) or supervision (in the case of PAs) of a physician. Examples of the types of services that APNs and PAs may provide include services that traditionally had been reserved for physicians, such as physical examinations, minor surgery, setting casts for simple fractures, interpreting x-rays and other activities that involve an independent evaluation and treatment of the patient's condition.

PAs and APNs first assisting at surgery are reimbursed at 13.6 percent of the full fee schedule, which is 85 percent of the 16 percent first-assisting fee paid to a physician. For services performed in a hospital, Medicare reimburses PAs at the lesser of the actual charge or 75 percent of the physician fee schedule. This payment limit applies to PAs practicing in a hospital or in a Health Professional Shortage Area (HPSA).

NPs can be reimbursed directly. Payment for the services of a PA may be made only to the qualified employer of the PA who must be enrolled in the Medicare program. PAs must bill through their employer or contractor, which could be a PA-owned corporation.

Certified Nurse-Midwife (CNM)

Medicare rules require that professional services provided by CNMs be reimbursed at 65 percent of the physician fee schedule (Part B deductible and coinsurance applies). CNMs can be reimbursed directly. When a CNM provides services with a collaborating physician and a single global fee is paid, the practitioners must allocate it between them. CNMs must enroll in the Medicare program and be assigned a National Provider Identifier (NPI) number that alerts the third-party administrator to implement the 35 percent discount rule.

Coverage is available for services furnished by nurse-midwives that are licensed as such and legally authorized to provide services in their state of licensure which otherwise would be provided by a physician.

Certified Registered Nurse Anesthetist (CRNA)

Medicare rules require that professional services provided by CRNAs be reimbursed at the lesser of charges or 100% of the anesthesiologist fee schedule (Part B deductible and coinsurance applies). CRNAs can be reimbursed directly. CRNAs must be certified by the Council on Certification of Nurse Anesthetists or the Council on Recertification of Nurse Anesthetists. CRNAs must enroll in the Medicare program and be assigned a National Provider Identifier (NPI) number that alerts the third-party administrator to implement the correct fee schedule.

Dental Hygienists (DH)

Dental services in connection with the care, treatment, filling, removal or replacement of teeth or structures directly supporting the teeth are not covered under the Medicare program.

COLORADO MEDICAID

Medicaid is a federal-state partnership which is jointly administered and funded by states and the federal government. The program provides health care coverage to approximately 58 million eligible low-

income Americans. To qualify for a federal match, states must include hospital services, prevention services, skilled nursing and home health care coverage for adults and additional prevention and treatment services for children, i.e., the early periodic screening, diagnostic treatment (EPSDT) program. Unlike Medicare, Medicaid has a required state match, in Colorado the match is equally split between the federal and state government (50/50). Beyond required coverage for children; each state has latitude in setting eligibility standards as a percentage of the federal poverty level (FPL).

Colorado Medicaid rules state that services provided by PAs, APNs, CRNAs and CNMs be reimbursed at 100 percent of the physician fee schedule. Further, APNs, CRNAs and CNMs can bill Medicaid directly for services provided. PA services must bill through their supervising physician.²³¹

Colorado Medicaid rules allow for the reimbursement of nine specified preventive dental service codes for Medicaid-enrolled children (20 and under) that are provided by unsupervised DHs at 100 percent of the dentist fee schedule. These services reflect the DH scope of practice for unsupervised services. Unsupervised DHs may bill Medicaid directly. DHs employed by a dentist, clinic or institution may not submit claims individually. There is no Medicaid dental coverage for adults.^{232 233}

COLORADO CHP+

The Colorado CHP+ program is health insurance coverage for low-income children (18 years of age and younger) and pregnant women (19 years of age and older) who do NOT have Medicaid or any other type of health insurance. CHP+ reimburses at 100 percent of the physician fee schedule for services provided by PAs, APNs, CRNAs and CNMs. CHP+ provides coverage for services provided by unsupervised DHs. However, the state contracts with Delta Dental of Colorado to administer the CHP+ dental benefit and, as of 2008; Delta Dental did not reimburse independent billing by DHs. ²³⁴

RURAL HEALTH CLINICS (RHC) AND FEDERALLY QUALIFIED HEALTH CENTERS (FQHC)

RHCs and FQHC are federally designated clinics in medically underserved areas or health professions shortage areas and in the case of RHCs, must be located in a rural area. NPs, CNMs and PAs are reimbursed at the general fee-for-service Medicare rate. If employed by a RHC or FQHC, reimbursement is made to the clinic. Reimbursement is an all-inclusive rate for each service provided to Medicare and Medicaid patients. Medicaid rates are cost-based while Medicare pays a discounted per visit fee which is adjusted based on whether provided in a rural or urban setting. PAs, NPs and CNMs are paid the same visit rate as physicians.

PRIVATE INSURERS

Several health insurers doing business in Colorado responded to CHI's request for information regarding their reimbursement policies for APNs and PAs. Although there is no uniform set of policies that govern reimbursement for mid-level providers, in general, the health plans reimburse for services provided by APNs and PAs within their scope of practice and credential them accordingly. Reimbursement policies tend to be market and geographic specific and rates are negotiated as they would be with a physician, physician group or the employer of the non-physician providers. Among non-physician primary care providers that bill separate from a collaborating or supervising physician, the provider must have a unique provider billing number.

Evidence-based Policy Recommendations

POLICY RECOMMENDATIONS FROM SOC ADVISORY COMMITTEE

DENTAL HYGIENISTS (DHs)

FINDINGS FROM EVIDENCE-BASED REVIEW - The evidence found that dental hygienists in unsupervised practice can competently deliver a range of oral health care preventive services including dental hygiene care such as teeth cleaning, application of fluoride varnishes and sealants within their scope of training, education and licensure in Colorado. Further, that the quality of care provided by dental hygienists is at least comparable to that provided by dentists, primarily in the areas of prevention and maintenance of healthy oral hygiene practices. It also was found that unsupervised practicing hygienists facilitate referrals to dentists for follow-up care.

UNRESOLVED PRACTICE ISSUE - DHs practicing within the full scope of their license, as defined in statute and evidenced by successful completion of their required education and knowledge base, face a current statutory restriction with regard to making a dental hygiene diagnosis, specifically in the situation where a DH could inform a patient or the parent of a child patient about the presence of caries or gum problems. Although DHs receive education in the evaluation, identification and dental hygiene diagnosis of oral hygiene-related diseases, they are unable to specifically inform the patient, parent or guardian for example, that the reason a sealant cannot be applied to their teeth or their child's teeth is due to the presence of dental caries. Of the six other states where DH practice acts were examined, none permitted that a dental hygiene diagnosis could be completed by a dental hygienist.

Resolving this issue could enable more specific, accurate and timely communication between patients and dentists upon referral by a licensed dental hygienist. A dental hygiene diagnosis could motivate the patient and provide a sense of importance to seeking necessary follow-up evaluation and care. On the other hand, an inaccurate dental hygiene diagnosis could lead to an unnecessary referral and delayed treatment of an undiagnosed condition, possibly increasing malpractice liability for a dentist who accepts referrals from dental hygienists. As there is no strong evidence basis for either of these possible scenarios, changes in policy must be supported by careful consideration of the balance between potential benefits and potential harms, both important quality of care issues.

BARRIERS TO PRACTICE - Reimbursement policies wherein not all dental payers in the state directly reimburse DHs for services provided and authorized under their current scope of practice have been identified as a potential barrier to practice, though there may be additional reasons that impede a dental hygienist's ability to provide care within their scope of education and training in settings of limited dental care access.

DH Recommendation – The SOC Advisory Committee recommends that an evaluation be conducted and options recommended for reimbursement policies which would enhance the use of dental hygienists in areas of the state where oral health access is lacking.

ADVANCED PRACTICE NURSES (APNs)

FINDINGS FROM EVIDENCE-BASED REVIEW - The evidence-based review found that APNs working as members of interdisciplinary health care teams deliver quality health care comparable to physicians in a variety of settings while receiving high patient satisfaction ratings. CNMs and CRNAs were found to provide quality specialty care without the direct supervision of a physician, often operating under specific practice protocols developed in consultation with a licensed physician. Further, that consultation

and referral to other appropriate providers consistent with training and scope of practice is a necessary component of primary health care to be exercised by all primary care providers.

BARRIER – A barrier to APN practice that was identified by members of the advisory committee, key informants and through public testimony was that some APNs, particularly those practicing in rural areas, find it difficult to identify physicians willing to enter into a collaborative agreement for purposes of prescriptive authority. Various reasons for this difficulty have been put forth, ranging from a shortage of primary care physicians in certain geographic areas, a lack of knowledge and understanding about the legal implications of the collaborative agreement, financial constraints imposed upon APNs when they must pay for the agreement and general liability concerns from both physicians and APNs.

APN Recommendations

1. Evaluate the efficacy of changes to APN law and regulations that would allow more flexibility in, or other changes to, the collaborative agreement requirement for prescriptive authority by APNs that would address the identified barriers.
2. Evaluate and recommend policies that would support and enhance the delivery of health care through interdisciplinary teams including physicians, APNs and other health care professionals.

CRNA Recommendation – Evaluate the efficacy of implementing changes currently authorized under the federal opt-out provision for Medicare Part A reimbursement to allow Colorado hospitals to bill for CRNA services directly taking into account hospital location and CRNA practice experience.

MODELS OF CARE POLICY RECOMMENDATIONS

Oral Health Recommendation – Consider conducting a feasibility study to evaluate the costs, benefits and quality of care considerations for Colorado to develop training programs for Community Dental Health Coordinators, Advanced Dental Hygiene Practitioners and/or Dental Therapists as a means of expanding access to primary oral health in the state.

REIMBURSEMENT RECOMMENDATIONS

UNRESOLVED ISSUE - Colorado statutes (CRS 10-16-104) require that dental care plans reimburse for any service that may be lawfully performed by a person licensed to practice in Colorado. DHs were specifically referenced in this regulation to ensure that insurance carriers doing business in Colorado honor the individual scopes of practice of oral health care providers. However, dental carriers have argued that they are not insurance companies and are therefore exempt from this provision.

Colorado statute also indicates that an insurance company shall not be precluded from setting different fee schedules for different services performed by different health professionals, but that the same fee schedule shall be used for those health services that are substantially identical although performed by different professionals. The State of Colorado reimburses all licensed health care providers at the same rate for the same services provided under the Medicaid program. However, based on anecdotal information from private payers, this rule does not appear to be uniformly practiced among all private insurers.

Reimbursement Recommendation – Consider adding to the current reporting requirements imposed by HB 08-1389 a provision that would require insurers to disclose to the Colorado Insurance Commissioner their reimbursement policies regarding the reimbursement of allied health professionals providing identical services to physicians and dentists within their respective scopes of practice.

Reimbursement Recommendation – Consider requiring all vendors contracting with the State of Colorado for individuals covered by state-sponsored insurance programs and state-funded programs that directly deliver services to children and adults provide direct reimbursement to DHs and APNs for services provided within their respective scopes of practice.

POLICY MONITORING RECOMMENDATIONS

PROBLEM – Effective and informed policymaking assumes the availability of objective and reliable data, both to frame policy options and then to monitor the implementation of policies once enacted. In spite of recent foundation investments in health professions data, Colorado still suffers (as do most other states) from significant data deficits in the area of health professions workforce data. These data deficits result in sub-optimal estimates of workforce supply and the distribution of Colorado’s primary care workforce.

Data Collection and Policy Monitoring Recommendation – The governor and/or legislature should consider sponsoring legislation that would require the health professions licensing boards housed in the Department of Regulatory Agencies to collect additional information from all applicants for a new or renewed Colorado license such as practice setting (e.g., community health center, private clinic, solo practice, school-based health center), practice address, years in active practice, certifications held, date of birth, highest degree held and/or others to be determined.

UNRESOLVED ISSUE – Upon completion of an evidence-based review of the literature, one which employed rigorous standards for study inclusion, CHI staff has found that a consistent and generalizable body of evidence that can be applied to a Colorado context is lacking. The studies reported in the peer-reviewed literature have been conducted in select care settings and with specific population groups, thus limiting their application across populations and care settings.

Recommendation to build a Colorado-specific evidence basis for collaborative models of primary care - While negotiations continue to take place around elements of the Nurse Practice Act and the scope of practice of dental hygienists, the governor and/or legislature should consider authorizing demonstration projects to test the efficacy, safety and quality of care provided by APNs, PAs and dental hygienists as primary health care providers in medically underserved areas of Colorado. These studies should employ the highest standards of clinical and health services research to provide definite evidence of the processes and outcomes of care associated with various models of collaborative, interdisciplinary primary care practice.

Appendix A: Executive Order

OFFICE OF THE GOVERNOR
136 State Capitol Building
Denver, Colorado 80203
(303) 866 - 2471
(303) 866 - 2003 fax



Bill Ritter, Jr.
Governor

B 003 08

EXECUTIVE ORDER

Commissioning the Collaborative Scopes of Care Study and Creating an Advisory Committee

Pursuant to the authority vested in the Office of the Governor of the State of Colorado, I, Bill Ritter, Jr., Governor of the State of Colorado, hereby issue this Executive Order commissioning the Collaborative Scopes of Care Study and creating the Collaborative Scopes of Care Advisory Committee (the "Advisory Committee").

I. Background and Need

The health care system in Colorado involves a complex interface between individuals, patients, facilities, insurers, state policy and health care providers. One important aspect of the system is the availability of qualified health care professionals to provide appropriate, high quality care to the appropriate patient in the appropriate setting. It is clear from health manpower studies that we do not have sufficient numbers of providers, especially physicians and dentists, to meet the current needs of Coloradans. This problem is especially acute in rural and other underserved communities, where many individuals simply have no access to health care regardless of whether they are insured or can otherwise afford care. In addition, the threat of the next influenza pandemic, while marked by uncertainty in terms of when it will occur or with what severity, has highlighted the current inadequate health care workforce by revealing how meager our available medical provider surge capacity is, compared to what we would require in order to respond and mitigate the impact of a pandemic. Finally, it is apparent from the experience of other states that have negotiated local health care reform, that expansion of access is met with insufficient numbers of professionals to provide care for the newly covered individuals.

One approach currently being evaluated and adopted in other states has been to carefully examine the potential collaborative roles of other health care providers, including advanced practice nurses, physician assistants, and dental hygienists in meeting the medical and dental

needs in communities. There is a rich research literature comparing the health outcomes from nurses and hygienists that indicates there are systems and settings where high quality care with good health outcomes can be provided to patients by non-physician or non-dentist professionals.

A systematic review and synthesis of this research would be valuable to policy makers in evaluating regulatory policies that could be addressed to appropriately enhance the scope of practice for regulated health professionals in such a way to expand availability of care providers in the face of higher demand from either expanded access to care or public health emergencies while preserving and protecting high quality standards for care.

II. Mission and Scope

The Governor's Office of Policy and Initiatives shall commission a study involving the review and synthesis of the available research regarding expanded and collaborative scopes of practice for advance practice nurses, physician assistants, and dental hygienists. In initiating the study, the Governor's Office shall identify an appropriate research entity (the "research group") with documented skill, expertise, and experience in health services research and systematic evidence review and synthesis. The research group shall undertake a study of scopes of practice for advanced practice nurses, physician assistants, and dental hygienists in terms of the services that are delivered, the settings in which those services are delivered, and the quality of care provided.

The Advisory Committee is created to provide guidance and advice to the research group and shall work in collaboration with the Department of Regulatory Agencies and the Department of Public Health and Environment. Moreover, the Advisory Committee shall:

- A. Advise the research group on the study workplan, analytic framework, literature search, evidence evaluation, and evidence synthesis for the study.
- B. Work with the research group on creating a final study report for distribution to the Governor and the General Assembly. The report shall be delivered no later than December 31, 2008.

III. Membership

The Advisory Committee shall be composed of twelve (12) voting members, appointed by and serving at the pleasure of the Governor, as follows:

- A. The State Chief Medical Officer, who shall serve as the Advisory Committee Chair.
- B. Four physicians who hold unrestricted active Colorado medical licenses. One of these physicians shall practice as an anesthesiologist, one as a family physician, one as a pediatrician, and one as an obstetrician/gynecologist.

- C. Four advanced practice nurses (APN) who hold unrestricted active Colorado nursing licenses. One of these APNs shall practice in primary care, one shall practice in pediatrics, one shall be a certified nurse midwife, and one shall be a certified registered nurse anesthetist.
- D. A registered nurse who holds an unrestricted active Colorado nursing license and who is not an APN.
- E. A dentist who holds an unrestricted active Colorado dental license.
- F. A dental hygienist who holds an unrestricted active Colorado dental hygienist license.

The Advisory Committee shall also have seven (7) non-voting, *ex-officio* members, serving at the pleasure of the Governor, appointed as follows:

- A. One Democratic and one Republican member of the Colorado Senate, appointed by the Governor in consultation with the President and Minority Leader of the Senate.
- B. One Democratic and one Republican member of the Colorado House of Representatives, appointed by the Governor in consultation with the Speaker of the House of Representatives and the Minority Leader of the House of Representatives.
- C. The Executive Director of the Department of Regulatory Agencies or his designee.
- D. The Executive Director of the Department of Health Care Policy and Financing or her designee.
- E. A representative from the Governor's Office of Policy and Initiatives, appointed by the Governor.

IV. Staffing and Resources

The Office of the Governor, in consultation with the Advisory Committee, shall identify the research entity to undertake the study, identify and secure resources to fund the research study, and find resources to support the Advisory Committee. The Office of the Governor shall have the power to accept money and in-kind contributions from private entities, but only to the extent such donations are necessary to cover its expenses, including but not limited to the research study discussed above.

Members of the Advisory Committee shall serve without compensation, but may, at the discretion of the Chair and upon the approval of the Office of the Governor, be reimbursed for any actual expenses incurred.

V. Directive

The Collaborative Scopes of Care Study is hereby commissioned and the Collaborative Scopes of Care Advisory Committee is hereby created.

VI. Duration

This Executive Order shall remain in force until January 31, 2009, at which time the Advisory Committee shall be dissolved.


GIVEN under my hand and the
Executive Seal of the State of
Colorado this seventh day of
February, 2008.

Bill Ritter Jr.

Bill Ritter, Jr.
Governor



Appendix B


**Collaborative
Scopes of Care**
ADVISORY COMMITTEE

Voting Members

- Ned Calonge, MD, MPH, Chair, Chief Medical Officer, Colorado Department of Public Health and Environment
- Luke J. Casias, MD, Family Physician, Animas Family Medicine, Hesperus
- Steven C. Holt, MD, Chairman, OB/GYN Department, Rose Medical Center
- Barbara Hughes, CNM, MS, MBA, FACNM, Director, Women's Service Line and Nurse-Midwifery, Saint Anthony Central Hospital, Centura Health
- Helen E. Lester, LPN, MSN, Director, Oncology/Infusion, San Luis Valley Regional Medical Center, Alamosa
- Shirley B. McKenzie, PNP, MS, Greenwood Pediatrics, Centennial
- Mark S. Patterson, RDH, BS, Dental Hygiene Program Director, Colorado Northwestern Community College, Rangely
- Jeanne M. Salcetti, DDS, MS, President, Colorado Dental Association
- Alex V. Slucky, MD, President, Colorado Society of Anesthesiologists
- Karen J. Tomky, MSN, CFNP, Owner, Centennial Family Health Center, LLC, Olney Springs
- Susan F. Townsend, MD, Neonatologist, Pediatrix Medical Group of Colorado, Greenwood Village
- Douglas E. Warnecke, CRNA, President, Colorado Association of Nurse Anesthetists
- Steve Kudebeh, PA-C, Denver Health and Hospitals

Ex-officio Members

- The Honorable Betty Boyd, State Senator
- The Honorable Bill Cadman, State Senator
- Cody Belzley, Senior Policy Analyst, Governor's Office
- The Honorable Ellen Roberts, State Representative
- Sandeep Wadhwa, MD, MBA, Medicaid Director and Chief Medical Officer, Colorado Department of Health Care Policy and Financing
- The Honorable Sara Gagliardi, State Representative
- Susan T. Miller, Healthcare Section Director, Colorado Division of Regulatory Agencies

Appendix C Study Methods

Level One Screen: Abstract review

Eligible studies included in the abstract review contained the words *primary care, community-based, family medicine, child health or pediatrics, public health and/or general practice, anesthesia care or dental/oral health care* and referenced one of the primary care providers included in the key research questions. Finally, the focus of the research related to one of the three key research questions that framed the meta-analysis.

Utilizing these threshold criteria, abstracts identified through the literature search were screened and scored with the Screening Form (see Appendix C) to assess whether a full article review would be conducted. Studies eligible for full review included at least three of the seven themes included on the initial Screening Form including *primary care, scope of practice, quality, safety, effectiveness or efficacy, cross-disciplinary models of primary care, evidence-based models of primary care, access for underserved populations*.

Any abstract not meeting this threshold level of relevance to the key research questions did not have a full review.

Level Two Screen: Threshold criteria for a full article review

The following questions guided whether staff would conduct a full evidence-based review of the article.

1. For existing meta-analyses, did the authors provide justification for inclusion/exclusion criteria pertaining to the studies reviewed?
2. For individual studies, were terms used to describe the study objectives well defined?
3. Did the study design attempt to minimize errors in data collection methods? Were the data collected appropriate and relevant to the research questions? Were the data verified and validated?
4. Did the researchers validate the data and control for possible biases or confounders by using methods to ensure construct validity, statistical validity and internal and external validity?
5. Did the study meet accepted research standards such as utilizing a study design appropriate to research questions, determine adequate sample size and appropriate data collection methods, use blind or double-blind protocols for subject selection, minimize sources of subject selection bias and control for subject attrition?
6. Was the appropriate level of analysis chosen to answer the research questions?
7. For meta-analyses, was the justification for combining data appropriate?
8. Was heterogeneity of studies addressed in the meta-analysis framework?
9. Were results accurately reported, that is, no discrepancies between text and tables?

10. Were conclusions justified by the data collected and analysis performed?
11. Were issues related to health professional education and training or regulatory framework under which clinicians are allowed to practice addressed in the study?
12. Was practice setting addressed as a mediating factor in the discussion of study findings?

Level Three Screen: Full article review

Articles passing the abstract review criteria were retrieved and received a full review with scoring. Full article reviews were judged according to the questions articulated in the Level Two screen. Each full article review was evaluated separately by at least two reviewers using the coding index described in the Article Review Form. If a discrepancy occurred in scoring between reviewers, a third reviewer scored the study and the three reviewers worked to reach consensus on the scoring of the study elements.

Appendix D

Screening Form for Literature Review

Article title _____
Author(s) _____
Reviewer _____

ABSTRACT SCAN

At least three of seven themes must be evidenced in the abstract and the abstract must include a reference to empirical findings to qualify for a full article review.

1. Does article contain one or more of the following themes? [Check if present]
 - Primary care (e.g. community-based, family medicine, public health, oral health, child health or pediatrics and/or general practice)
2. Scopes of practice of:
 - Nurse Practitioners
 - Physician Assistants
 - Certified Registered Nurse Anesthetists
 - Certified Nurse midwives
 - Dental Hygienists
3. Quality, safety and efficacy of:
 - Nurse Practitioner
 - Physician Assistant
 - Certified Registered Nurse Anesthetists
 - Certified Nurse midwives
 - Dental Hygienist
4. Evidence-based models of care delivery such as telemedicine, non-physician primary care clinics discussed
 - Models of interdisciplinary, cross-disciplinary care
5. Is access to quality health care addressed by the study? [Check if present]
 - Yes
 - No
 - Unknown/Needs follow up
6. Does this study address underserved populations?
 - Yes
 - No
 - Unknown/Needs follow up
7. Does the article include empirical findings?
 - Yes
 - No
 - Unknown/Needs follow up

FULL ARTICLE REVIEW

Single Study

1. Research Methods and Data Collection
 - Was the study design described in sufficient detail to judge its appropriateness to the research questions?
 - Were the research methods clearly described?
 - Were data elements and data collection methods clearly described?
2. Sampling Strategy/Subject Inclusion Criteria
 - Was the study group or target population adequately described?
 - Was the subjects/controls or intervention group appropriate for the study design and research questions to be answered?
3. Data Analysis
 - Was the data analysis plan adequately described?
 - Were the data findings appropriate to the study design and research questions?
 - Were data limitations discussed?
4. Results
 - Was there a clear statement of the findings?
 - Did the results relate directly to study aims and research questions? Were sufficient data presented to support findings?
5. Generalizability
 - Are the findings generalizable to the general population?
 - Was the context/setting of the study described sufficiently to allow comparisons to other contexts and settings?

Each study attribute was categorized using a 1-4 scoring algorithm:

4 = Yes

3 = No, but not a serious threat to validity

2 = No and a serious threat to validity

1 = Not applicable to this type of study

Meta-Analysis

1. Research Methods and Data Collection
 - Were study designs adequately described and comparable across studies?
 - Were key research questions similar enough across studies to be able to summarize findings in a coherent way?
 - Was the inter-study evidence assessment method and scoring system adequately described?
 - Were data elements and collection methods across studies of comparable quality and scope to draw inferences from aggregated study findings?
2. Sampling Strategy/Subject Inclusion Criteria
 - Were the target populations or subject selection criteria comparable across studies and appropriate to the research questions framing the meta-analysis?
 - Was the grading system and coding index used to compare studies adequately described?
3. Data Analysis
 - Was the data analysis conducted across studies of comparable quality, scope and rigor?
 - Were data limitations adequately and uniformly discussed across studies?
 - Were study findings categorized and presented in such a way as to delineate commonalities and differences between studies?
 - Did the discussion of analysis accounted for the variation in the study findings assessed?
 - Were summarized findings accompanied by tables, graphs? If so, were the findings adequately explained by the tabular formats?
 - Did the aggregated results specifically related back to the research questions framing the meta-analysis?
4. Generalizability
 - Were the aggregated findings generalizable to a single population group or the general population?
 - Was the context/setting of the meta-analysis described sufficiently to allow generalizability in other contexts and settings?

Appendix E

Summary of Common Themes and Issues Identified by Key Informant Interviews

COMMON THEMES

- 1) Reimbursement - A critical corollary to regulatory issues related to scopes of practice is the need for changes in both Medicaid and private insurance reimbursement policies for services provided by non-physician and non-dentist primary care providers.
- 2) Turf battles and politics – Tension and practice boundaries between different physician specialties and between physicians and non-physicians will be a major barrier to implementing any expansions or changes in scopes of practice for non-physician providers.
- 3) Malpractice - Issues of liability must be addressed if changes in physician/non-physician and dentist/dental hygienist practice relationships and new models of care are pursued.
- 4) Medical home - The concept of a medical home where care is continuous, appropriate and comprehensive is viewed by many as the most significant emerging model for integrating different providers into a patient-centered interdisciplinary team.
- 5) Prevention and health promotion - The evidence-based review should include studies that integrate prevention, health promotion and early intervention, to the extent possible, to *complement/expand/replace* the acute care model that currently defines most health care delivery systems.
- 6) Assurance of competency – Quality health care and protection of the public’s health and safety can best be assured with adequate systems in place to evaluate the competencies of all health care practitioners. Systems must be in place to ensure competency of health care providers including educational requirements, clinical competencies, licensure and continuing education requirements.
- 7) Attention to rural and urban differences – When evaluating models of care that hold promise, attention must be paid to the fundamental differences inherent in practicing in a rural, sparsely populated area as opposed to a densely populated urban area. Lack of availability of health care resources is a defining characteristic of most rural communities.
- 8) Consumer education - Consumers need to be educated about the roles, education and competencies of non-physician/non-dentist primary care providers.
- 9) Absence of behavioral health providers – The lack of inclusion of behavioral health providers was viewed by many as a significant shortcoming of the study.
- 10) The role of telehealth - Uses of technology in general, and telehealth in particular, should be explored as a component of innovative models designed to expand access to health care resources. Issues related to supervision and reimbursement should be highlighted.
- 11) Educational requirements - Any proposed changes to scope of practice or recommendations for innovative models of care must be accompanied by a critical examination of educational content

(didactic) and clinical training. Education and training content must emphasize interdisciplinary teams and cross-disciplinary approaches to primary care delivery.

BARRIERS IDENTIFIED

- “Protecting professional turf ” and “fear of the economic impact of changes in scope”
- Most health care professionals are not educated or provided clinical experiences in training to practice as a team; consequently they lack the skills to utilizing models that stress interdisciplinary teams.
- The current reimbursement system pays for acute care (treatment) rather than for preventive care; fee-for-service payment is on a procedure-by-procedure basis; and TABOR limits fiscal options on the public reimbursement side.
- Liability issues surrounding changes in scope and supervision.
- Differing views among physicians concerning what changes to the current health care system are needed, if any, is a barrier to implementing new models of care.

SPECIFIC CHANGES RECOMMENDED TO SCOPES OF PRACTICE

- 1) Advance Practice Nurses (APNs) - full prescriptive rights; evaluation of current levels of training and experience for APNs wanting to practice independently as primary care providers in a rural setting; and evaluate the appropriateness of the current collaborative agreement statutory requirement.
- 2) Dental Hygienists (DHs) – evaluate the current preliminary examination; and explore the efficacy of instituting a mid-level oral health provider that is educated at the master’s level (similar to an APN).
- 3) Certified Nurse-Midwives (CNMs) – Institute prescriptive authority; and evaluate the supervision requirement for new CNMs to address the difficulty of finding a supervising MD in rural areas.
- 4) Situation-specific modifications to scopes should be considered, including:
 - Allowing that supervision requirements be met by remote contact with physicians for those practitioners practicing in communities where physicians, dentists and specialists are unavailable or limited;
 - Considering broader scope for mid-level providers that practice in communities where physicians, dentists and specialists are unavailable or limited; and
 - Site-specific scope authority is granted to increase access in some areas of the state.

MODELS OF CARE

- 1) Medical Home - A patient-centered model of primary care that emphasizes medical homes should be at the center of policy options that discuss scopes of practice and appropriate roles for primary care providers, particularly interdisciplinary models of care.
- 2) Integrate care - Only integrated care practice models that include physical, mental and dental care with a wellness orientation should be considered.
- 3) Telehealth - Use of health technology, such as telepharmacy or teleradiology, should be integral to models of care intended to increase access to health care in rural underserved areas.
- 4) Group visits - Studies show that “group care” is highly effective at producing positive outcomes and is a very efficient practice model when health care resources are limited.

- 5) The study should identify care models that address “what could be” rather than “what is” and they should be informed by evidence and the changing demographics of the state, demand for health care, areas of high incidence of chronic diseases such as diabetes, cancer and heart disease and areas with poor access to maternal and child health care services.

Specific examples of models of care cited by key informants included:

- The *Kaiser Permanente* model of organizing care that clearly defines scopes of practice for various types of health care providers. Kaiser is very good at utilizing APNs and physician’s assistants as primary care providers in a fully integrated delivery system.
- *Community Health Centers* (FQHCs and CHCs) efficiently utilize APNs, PAs and dental hygienists in medically underserved areas.
- *Stanford Model for Diabetics* is an innovative practice model that includes reimbursement for group visits for prevention, patient education and wellness promotion.
- *Dental Hygienist Co-location Project* - Delta Dental Foundation of Colorado is funding this demonstration project to promote access to primary dental care provided by dental hygienists in pediatric offices and includes Medicaid reimbursement.

CONCERNS RAISED BY KEY INFORMANTS

- “This study is like the cart before the horse. The ideal situation would have been to bring doctors and nurses together to discuss the barriers to access and quality of care.”
- Scope of Practice issues should be looked at as part of a systemic effort to reform the health care system; scope of practice modifications alone will not fix access issues (several suggested loan repayment programs); it is more about relationships than scope of practice barriers.
- Health care consumers and other providers should have been included on the advisory committee, including behavioral health providers, physician assistants and health care “extenders” such as patient navigators, behavioral health consultants and community health workers.
- The evidence-based review must factor in the following or otherwise the results will be distorted: level of training of the mid-level providers included; results from studies including both direct supervision and unsupervised practice; years of experience of the practitioner and the severity of illnesses being treated by the practitioners included in the study.

Appendix F
Maps of Primary Care Resources in Colorado



Map I. Types of Anesthesia Providers by Colorado's Rural and Critical Access Hospitals



Rural hospital categories

- Non-critical access rural hospital
- ★ Critical access hospital

Services provided

- Anesthesiologist
- CRNA
- Anesthesiologist/CRNA
- No surgery provided

County designations

- Rural
- Urban

Source Information

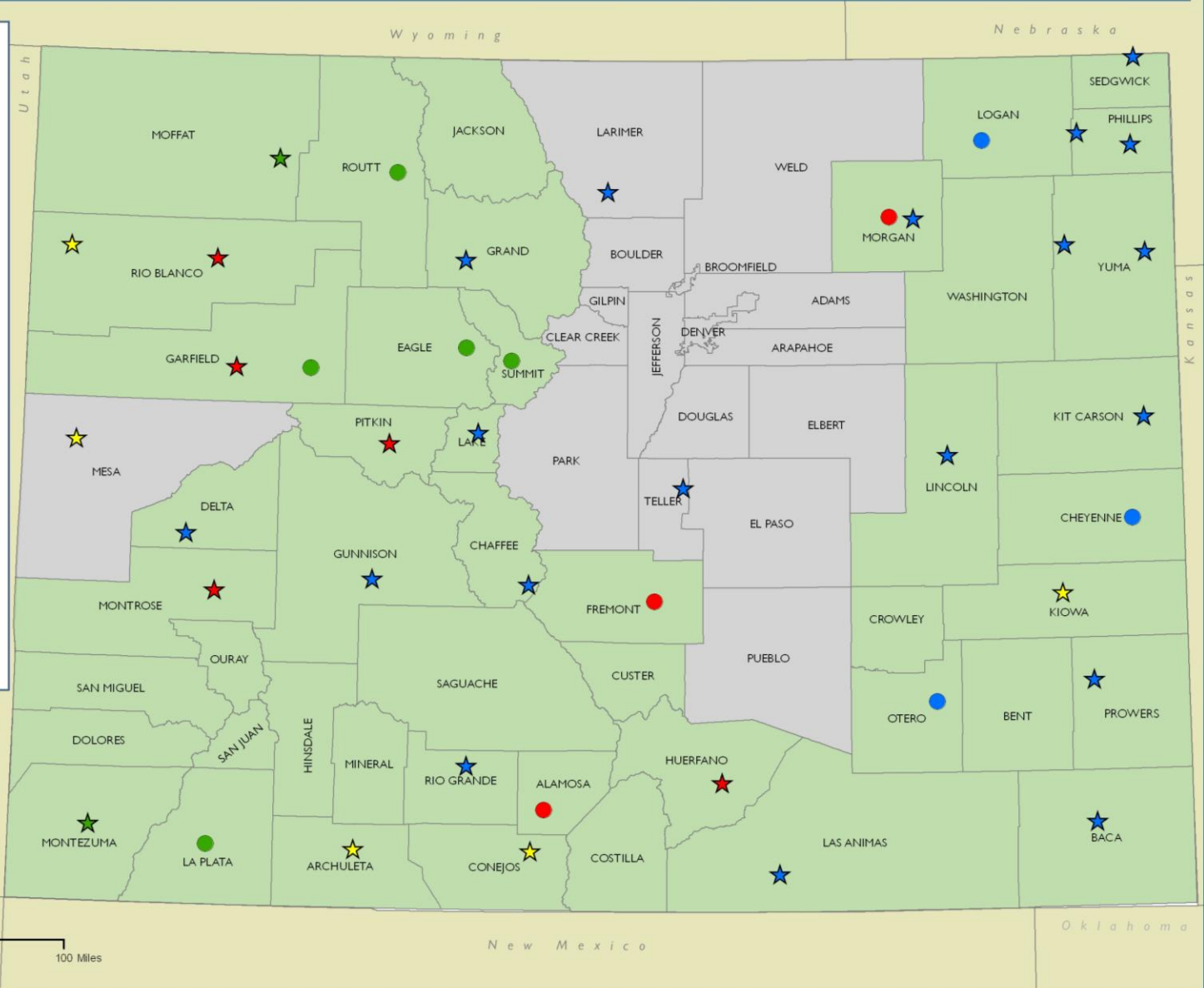
Colorado Rural Health Center (CRHC), Critical Access Hospital (CAH) Service Line Tracking Project, November 2008. www.coruralhealth.org

Additional information regarding rural hospitals were attained from the Colorado Hospital Association rural membership survey, December 2008, and CHI phone inquiries.

Urban and rural classifications based on U.S Census 2000 tabulations

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org





Map 2. Colorado's Medically Underserved Areas (MUA) and Populations (MUP), and Locations of Rural Health Clinics (RHC), Federally Qualified Health Centers (FQHC), and School-based Health Centers (SBHC)



Clinic types, and the percent that employ full and part-time NPs, PAs, CNMs and DHs

- ★ **RHCs (clinic)**
NP(51%),PA(62%),CNM(NA%),DH(NA%)
- ★ **FQHCs (330 grantees)**
NP(100%),PA(93%),CNM(47%),DH(80%)
- ★ **SBHCs (clinic)**
NP(76%),PA(32%),CNM(0%),DH(8%)

MUA/MUP types

- Medically Underserved Areas (MUA)
- Medically Underserved Populations (MUP)
- Not Designated
- Governors Exception MUP

Source Information

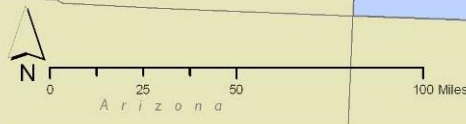
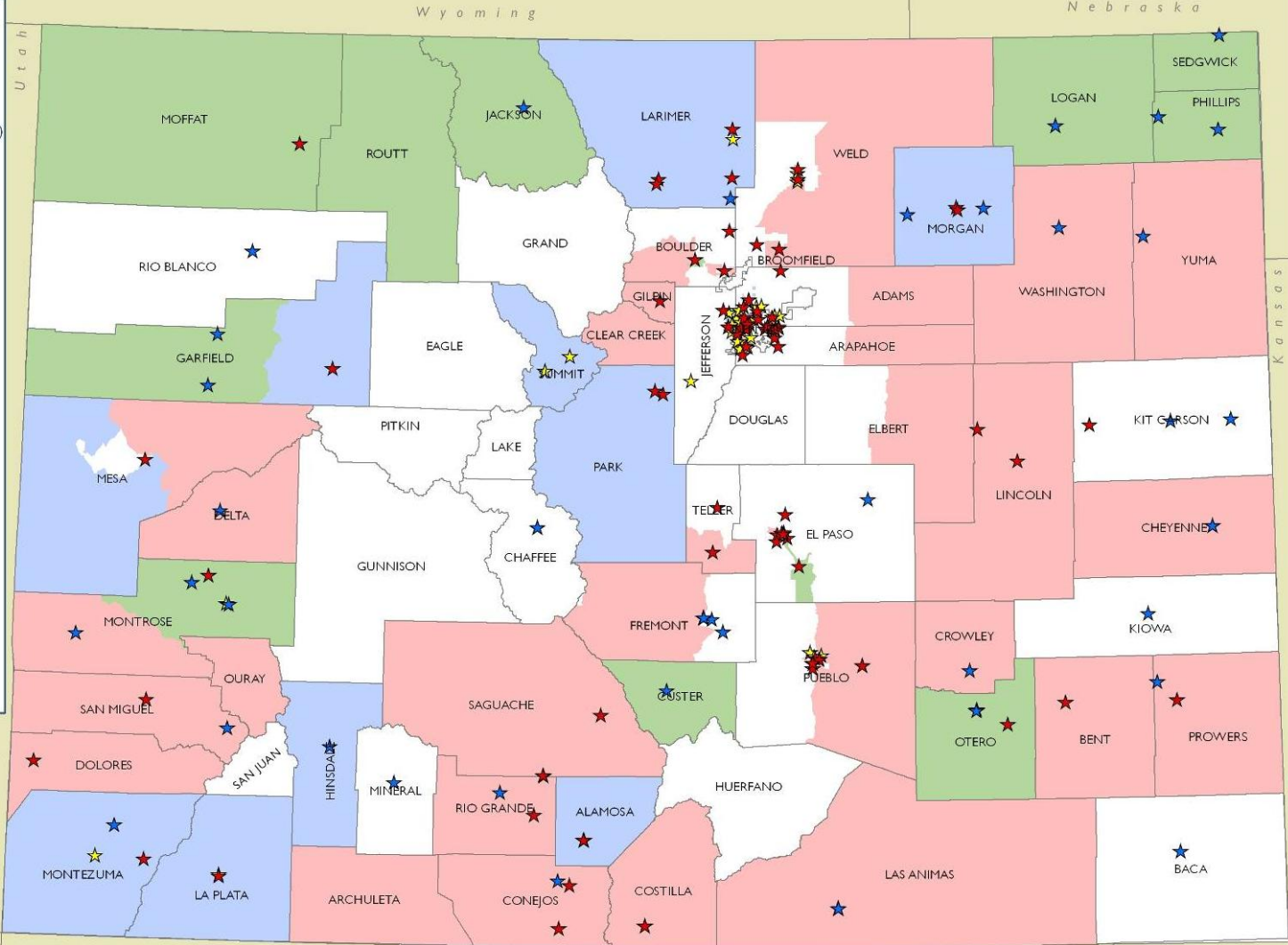
FQHC: The Colorado Community Health Network (CCHN), 7/2007, www.cchn.org

RHC: Colorado Rural Health Center 11/2008, www.coruralhealth.org

SBHC: Colorado Association for School-Based Health Care, 2008, (CASBHC) www.casbhc.org

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org



Notes: NP=Nurse practitioner
PA=Physician assistant
CNM=Certified nurse midwife
DH=Dental hygienist
NA= data not available



Map 3. Colorado's Primary Care Workforce: Practicing Physicians and registered Advanced Practice Nurses (APN) by County and below 200% of Federal Poverty Level (FPL)



Primary care types

- Primary care physicians
- ▲ APNs

Percent of population with household incomes below 200% of the Federal Poverty Level

- 0% - 10%
- 10.1% - 25%
- 25.1% - 35%
- 35.1% - 50%
- >50%

Source Information

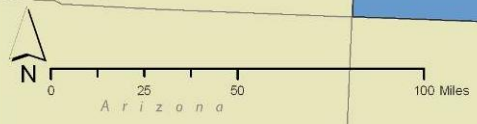
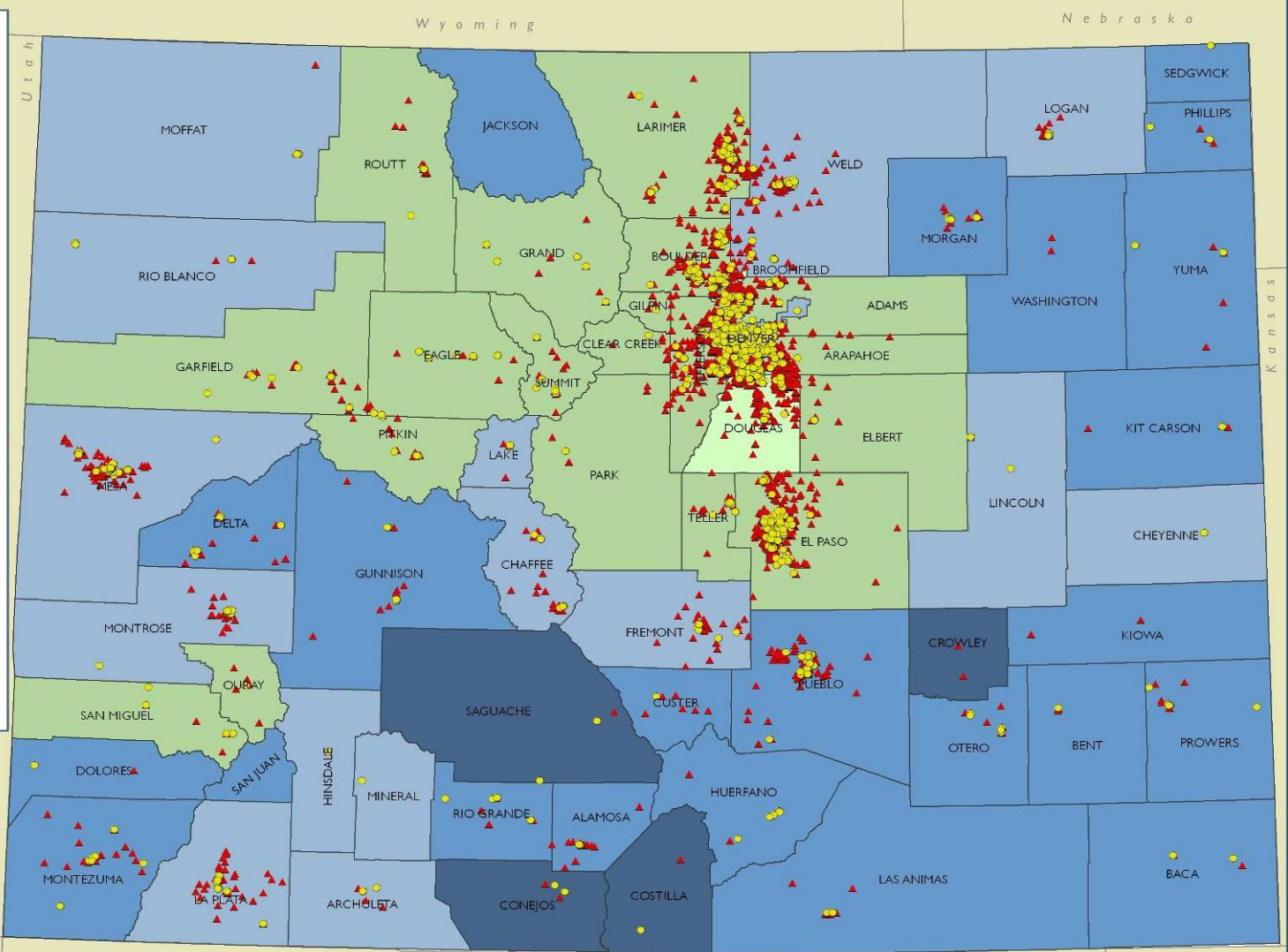
Advanced practice nurses include NPs, CRNAs, and CNMs. Data downloaded on 12/9/2008 from the Colorado Department of Regulatory Agencies(DORA). www.dora.state.co.us

Practicing primary care physicians include family medicine, general practice, internal medicine, and pediatrics. Data provided on 9/30/2008 by Peregrine Management Corporation. www.peregrine.us

Poverty data were tabulated by the U.S. Census Bureau at the request of the Colorado Health Institute. Data are based on a sample from the 2000 U.S. Census.

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org



Notes: Some individuals who are actively licensed as an Advance Practice Nurse may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 4. Colorado's Primary Care Workforce: The Proportion of Primary Care Practicing Physicians and Registered Advanced Practice Nurses (APN) by Rural Counties and Population (2008)



Primary care types

- Primary care physicians (yellow)
- APN (orange)

Approximate number of primary care providers by county

Absence of pie chart indicates no primary care professional in county

Total county population (2008)

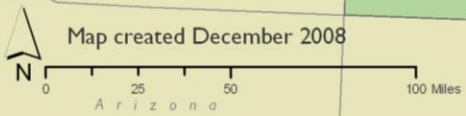
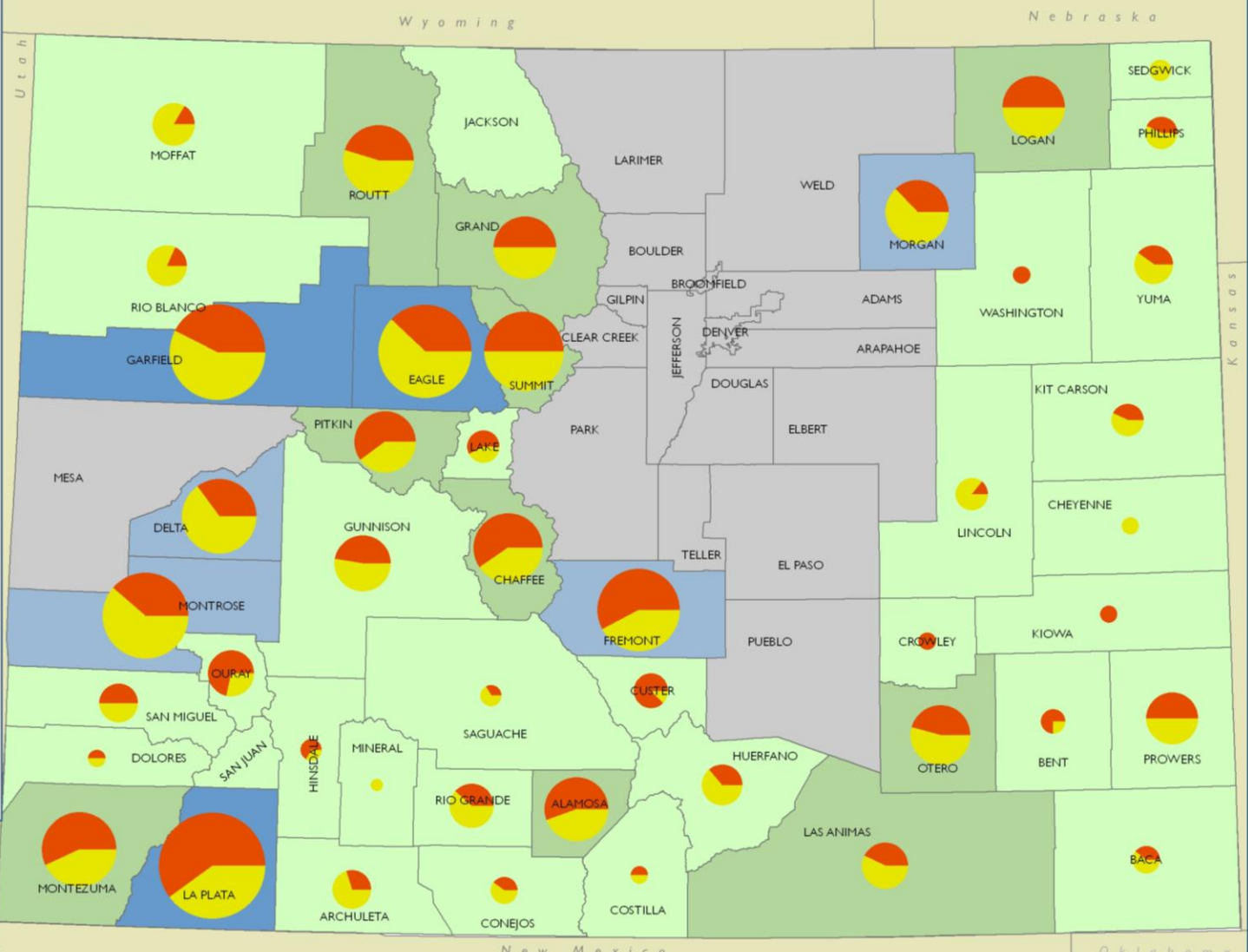
- 590 - 15,000 (lightest green)
- 15,001 - 30,000 (light green)
- 30,001 - 50,000 (medium green)
- 50,001 - 300,000 (dark green)
- Urban county (grey)

Source Information

Advanced practice nurses include NPs, CRNAs, and CNMs. Data downloaded on 12/9/2008 from the Colorado Department of Regulatory Agencies (DORA). www.dora.state.co.us

Practicing primary care physicians include family medicine, general practice, geriatrics, internal medicine, and pediatrics. Data provided on 9/30/2008 by Peregrine Management Corporation. www.peregrine.us

Population data are from the Colorado State Demography Office, Department of Local Affairs. 2008. <http://dola.colorado.gov/demog>

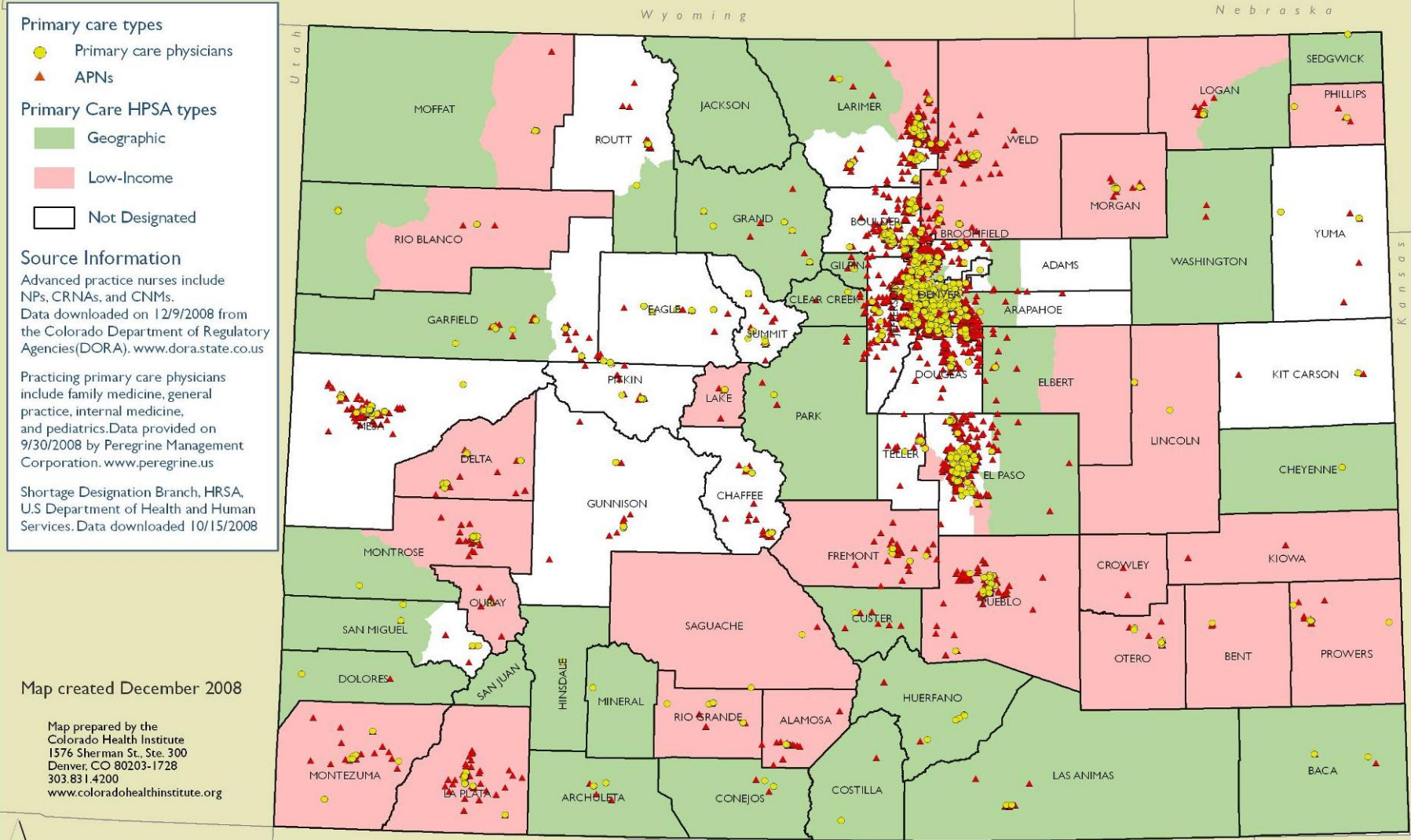


Notes: Some individuals who are actively licensed as an Advance Practice Nurse may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.

Map prepared by the Colorado Health Institute
 1576 Sherman St., Ste. 300
 Denver, CO 80203-1728
 303.631.4200
www.coloradohealthinstitute.org

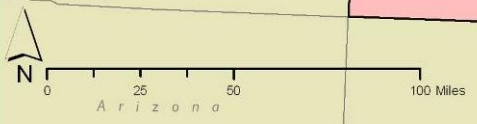


Map 5. Colorado's Primary Care Health Professional Shortage Areas (HPSAs) and Locations of Practicing Physicians and registered Advanced Practice Nurses (APN)



Source Information
 Advanced practice nurses include NPs, CRNAs, and CNMs. Data downloaded on 12/9/2008 from the Colorado Department of Regulatory Agencies(DORA). www.dora.state.co.us
 Practicing primary care physicians include family medicine, general practice, internal medicine, and pediatrics. Data provided on 9/30/2008 by Peregrine Management Corporation. www.peregrine.us
 Shortage Designation Branch, HRSA, U.S Department of Health and Human Services. Data downloaded 10/15/2008

Map created December 2008
 Map prepared by the Colorado Health Institute
 1576 Sherman St., Ste. 300
 Denver, CO 80203-1728
 303.831.4200
www.coloradohealthinstitute.org



Notes: Some individuals who are actively licensed as an Advance Practice Nurse may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 6. Colorado's Primary Care Workforce: Practicing Physicians and Physician Assistants by County and below 200% of Federal Poverty Level (FPL)



Primary care types

- Primary care physicians
- Physician assistants

Percent of population with household incomes below 200% of the Federal Poverty Level

- 0% - 10%
- 10.1% - 25%
- 25.1% - 35%
- 35.1% - 50%
- >50%

Source Information

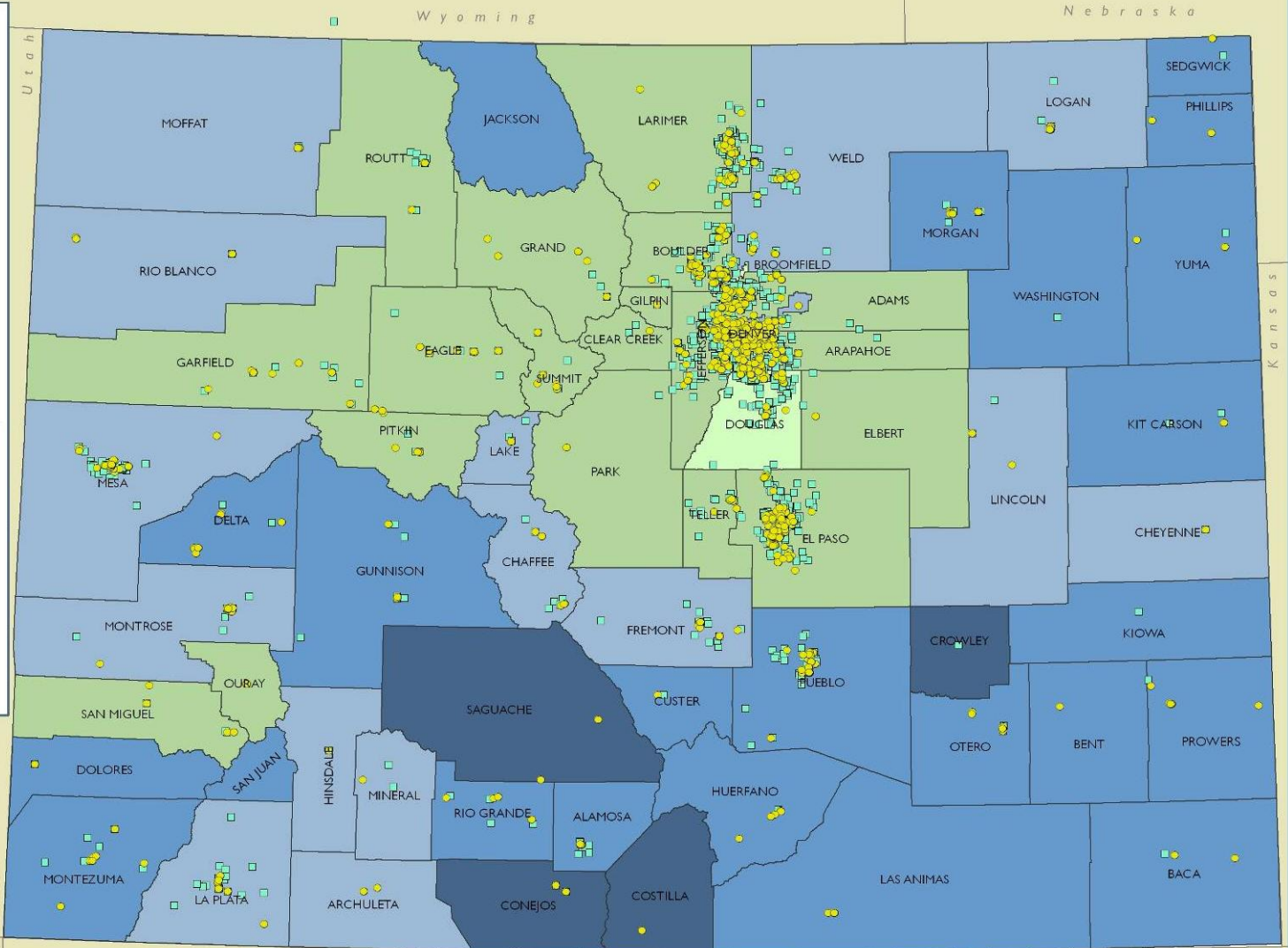
Data downloaded on 12/15/2008 from the Colorado Department of Regulatory Agencies(DORA). www.dora.state.co.us

Practicing primary care physicians include family medicine, general practice, internal medicine, and pediatrics. Data provided on 9/30/2008 by Peregrine Management Corporation. www.peregrine.us

Poverty data were tabulated by the U.S. Census Bureau at the request of the Colorado Health Institute. Data are based on a sample from the 2000 U.S. Census.

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org



0 25 50 100 Miles

Notes: Some individuals who are actively licensed as physician assistants may be working less than full time. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 7. Colorado's Primary Care Workforce: The Proportion of Practicing Physicians and Physician Assistants by Rural Counties and Population (2008)



Primary care types

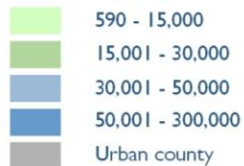
- ▾ Primary care physicians
- ▾ Physician assistants

Approximate number of primary care providers by county



Absence of pie chart indicates no primary care professional in county

Total county population



Source Information

Data downloaded on 12/9/2008 from the Colorado Department of Regulatory Agencies (DORA). www.dora.state.co.us

Practicing primary care physicians include family medicine, general practice, geriatrics, internal medicine, and pediatrics. Data provided on 9/30/2008 by Peregrine Management Corporation. www.peregrine.us

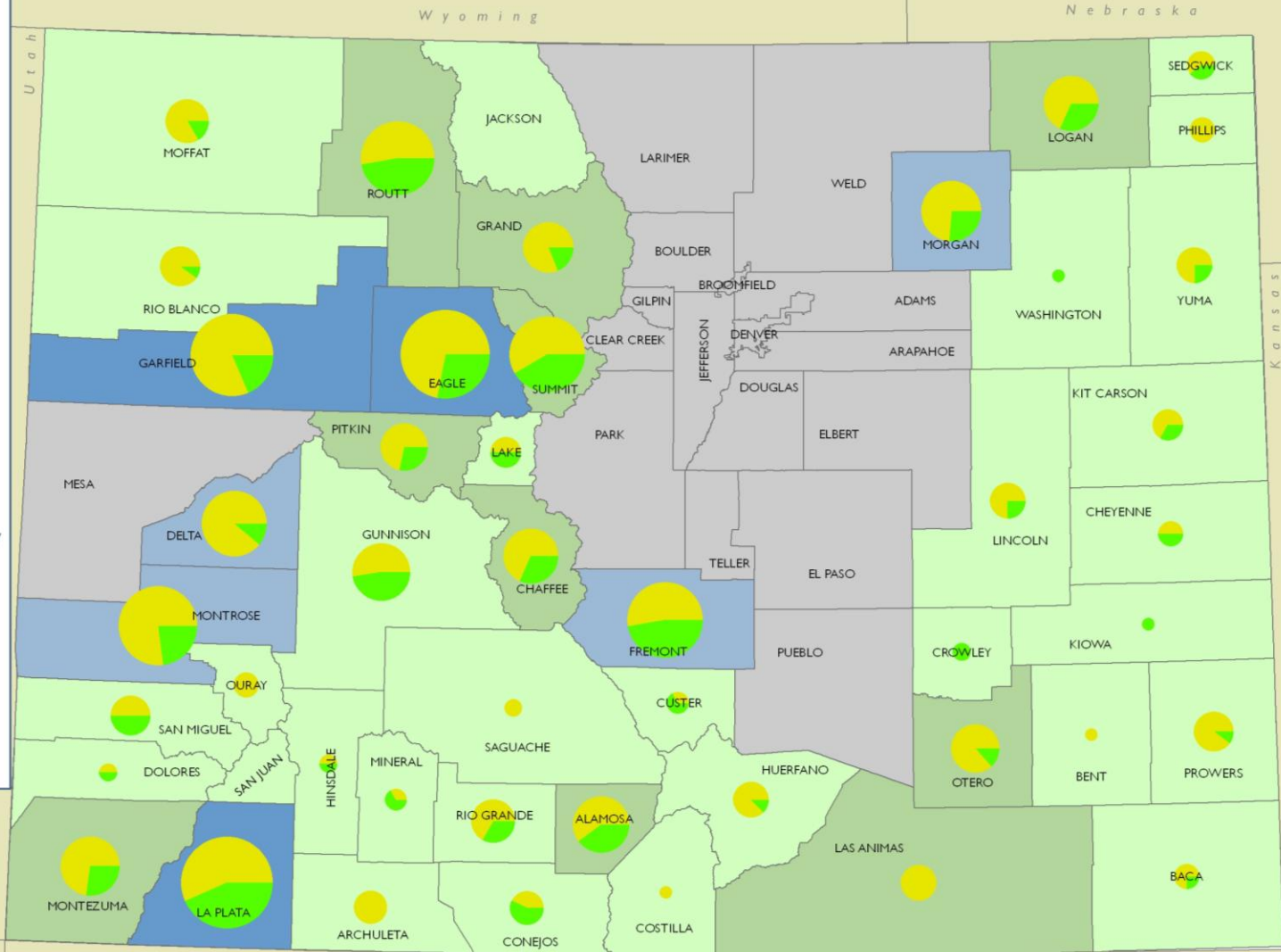
Population data are from the Colorado State Demography Office, Department of Local Affairs, 2008. <http://dola.colorado.gov/demog>

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org



0 25 50 100 Miles



Notes: Some individuals who are actively licensed as physician assistants may be working less than full time. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 8. Colorado's Primary Care Workforce: Dentists and Dental Hygienists by County and below 200% of Federal Poverty Level (FPL)



Primary care types

- + Dentists
- ◆ Dental hygienists

Percent of population with household incomes below 200% of the Federal Poverty Level

- 0% - 10%
- 10.1% - 25%
- 25.1% - 35%
- 35.1% - 50%
- >50%

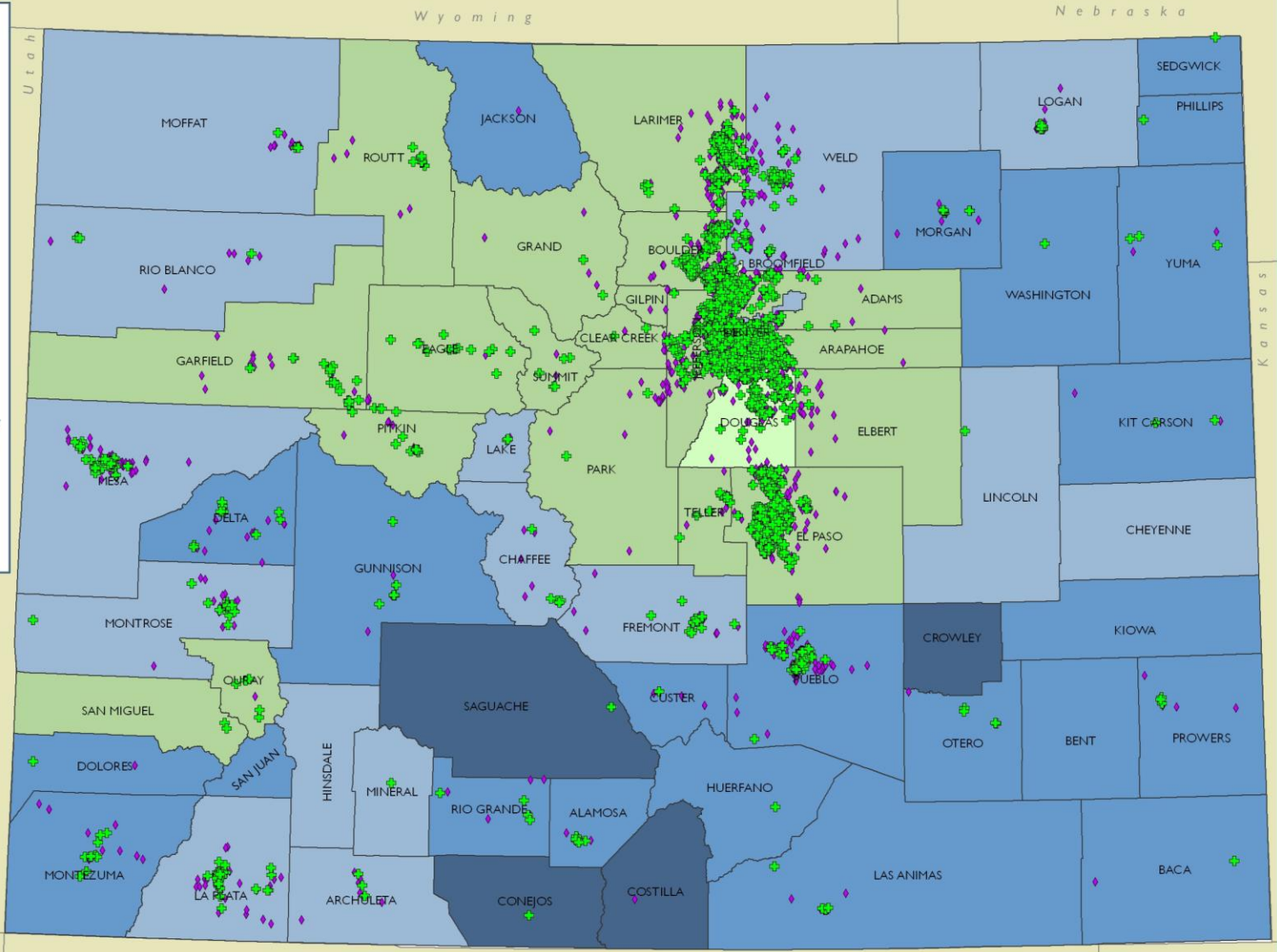
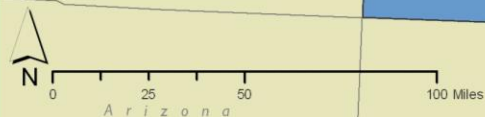
Source Information

Data downloaded on 12/15/2008 from the Colorado Department of Regulatory Agencies (DORA). www.dora.state.co.us

Poverty data were tabulated by the U.S. Census Bureau at the request of the Colorado Health Institute. Data are based on a sample from the 2000 U.S. Census.

Map created December 2008

Map prepared by the Colorado Health Institute
 1576 Sherman St., Ste. 300
 Denver, CO 80203-1728
 303.831.4200
www.coloradohealthinstitute.org



Notes: Some individuals who are actively licensed as dentists or dental hygienists may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 9. Colorado's Primary Care Workforce: The Proportion of Dentists and Dental Hygienists by Rural Counties and Population (2008)



Primary care types

- Dentists
- Dental hygienists

Approximate number of primary care providers by county

- ≤10
- 10-19
- 20-34
- 35-45

Absence of pie chart indicates no primary care professional in county

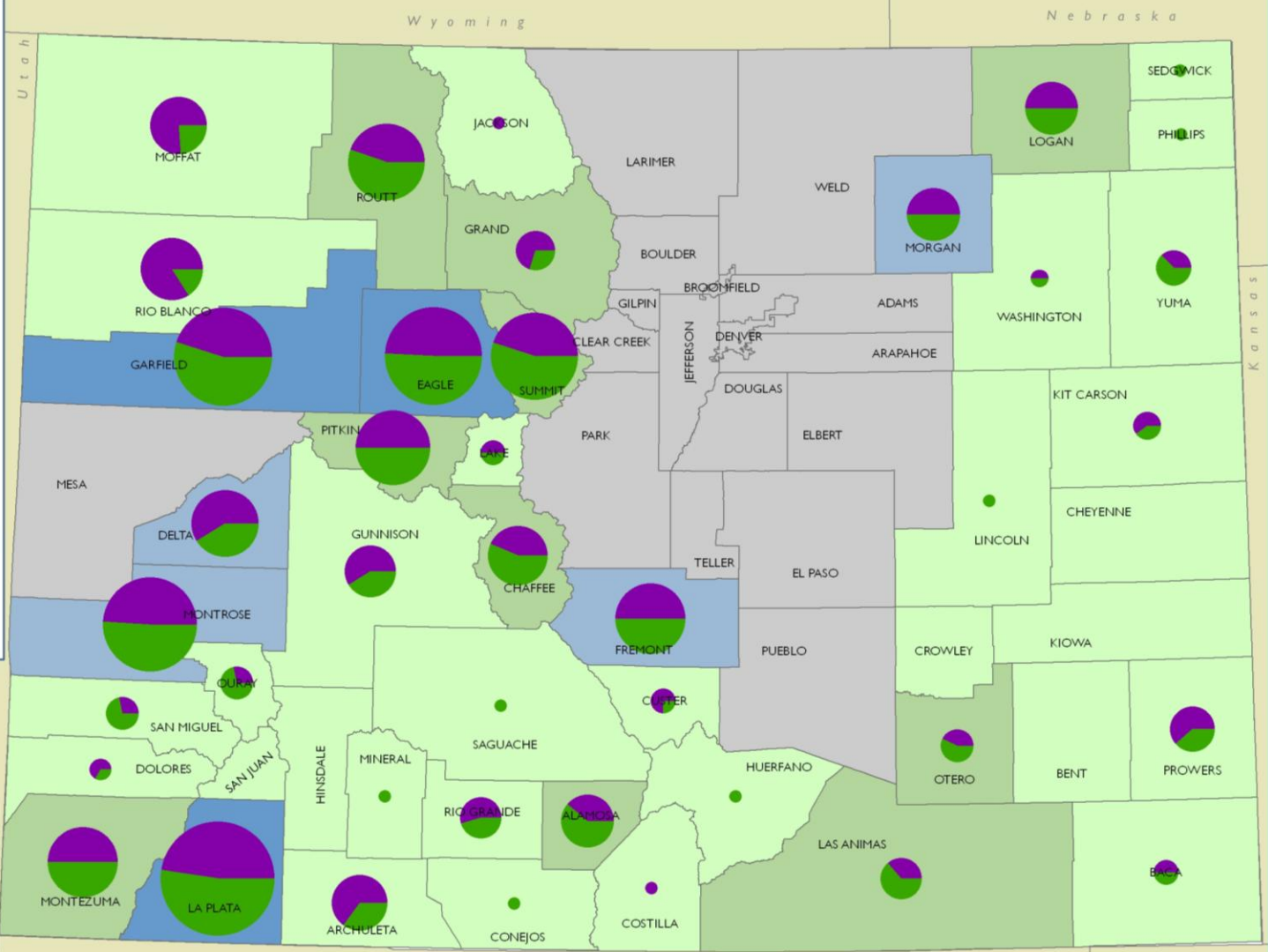
Total county population

- 0 - 15,000
- 15,001 - 30,000
- 30,001 - 50,000
- 50,001 - 300,000
- Urban county

Source Information

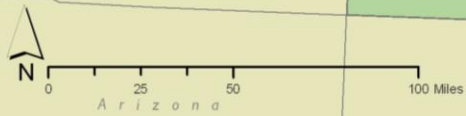
Data downloaded on 12/9/2008 from the Colorado Department of Regulatory Agencies (DORA). www.dora.state.co.us

Population data are from the Colorado State Demography Office, Department of Local Affairs. 2008. <http://dola.colorado.gov/demog>



Map created December 2008

Map prepared by the Colorado Health Institute
 1576 Sherman St., Ste. 300
 Denver, CO 80203-1728
 303.831.4200
www.coloradohealthinstitute.org



Notes: Some individuals who are actively licensed as dentists or dental hygienists may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.



Map 10. Colorado's Dental Health Professional Shortage Areas (HPSAs) and Locations of Dentists and Dental Hygienists



Primary care types

- + Dentists
- ◆ Dental hygienists

Primary Care HPSA types

- Geographic
- Low-Income
- Not Designated

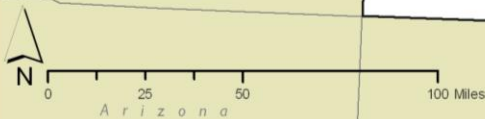
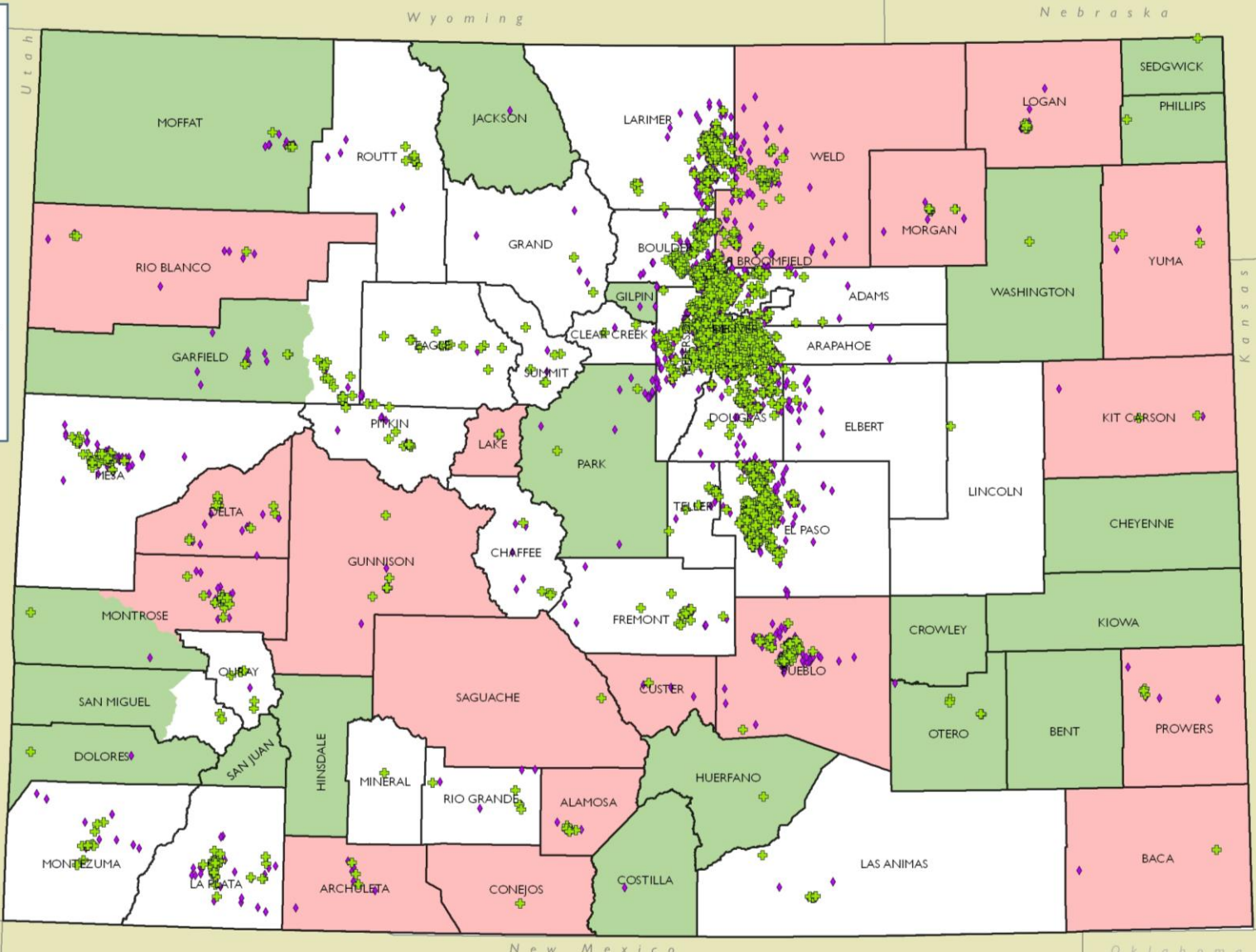
Source Information

Data downloaded on 12/15/2008 from the Colorado Department of Regulatory Agencies (DORA). www.dora.state.co.us

Shortage Designation Branch, HRSA, U.S. Department of Health and Human Services. Data downloaded 10/15/2008

Map created December 2008

Map prepared by the Colorado Health Institute
1576 Sherman St., Ste. 300
Denver, CO 80203-1728
303.831.4200
www.coloradohealthinstitute.org



Notes: Some individuals who are actively licensed as dentists or dental hygienists may be working less than full time or not at all in the profession. In addition, counts are based on the mailing address in the licensure file, and it is unknown whether this address is a home or a practice location; thus, it is not known with certainty that counts are representative of Colorado or a given county practice location.

Appendix G Primary Care Professions Matrix

| | Physician (MD, DO) ^{1, 2} | Nurse Practitioners ³ | Certified Nurse-Midwives | Certified Registered Nurse Anesthetists | Physician Assistant ⁴ | Dentist (DDS) ⁵ | Dental Hygienist ⁶ |
|------------------------------------|---|---|--|--|---|---|---|
| Licensure Requirements | Graduation from accredited medical school; pass national/state exam and minimum of one year of post-graduate training | Must graduate from accredited RN program. | Must graduate from an accredited RN program; must be board certified by the American Midwifery Certification Board | Must graduate from an accredited RN program; must be board certified by the American Association of Nurse Anesthetists | Must graduate from an accredited PA program; pass the national certifying exam; be at least 21 years of age | Must graduate from an accredited dental school; pass the ADA National Board Dental Examinations Part I and II; pass practical/clinical exam to demonstrate clinical competency and proof of malpractice insurance | Must graduate from an accredited dental hygiene program; pass the national board examination; pass a regional or state board clinical examination; pass the state board jurisprudence examination |
| Licensure Renewal | Every two years | Every two years | Every two years | Every two years | Every two years | Every two years | Every two years |
| Certifying Body⁷ | 24 officially recognized specialty boards | American Nurses Credentialing Center (ANCC); Pediatric NPs are certified by the Pediatric Nursing Certification Board (PNCB) ⁸ | American Midwifery Certification Board (AMCB) | American Association of Nurse Anesthetists (AANA) Council on Certification | National Commission on Certification of PAs | American Dental Association | American Dental Association |

¹ The Accreditation Council for Graduate Medical Education. Accessed October 20, 2008. <http://www.acgme.org/acWebsite/home/home.asp>

² http://www.osteopathic.org/index.cfm?PageID=ado_whatIs Accessed December 18, 2008

³ <http://www.dora.state.co.us/nursing/licensing/requirements.htm>, accessed October 31, 2008.

⁴ American Academy of Physician Assistants. <http://www.aapa.org/geninfo1.html>. Accessed Nov. 13, 2008.

⁵ http://www.abgd.org/docs/rules_index.htm accessed Dec. 11, 2008

⁶ The American Dental Association. Accessed Nov. 17, 2008. <http://www.ada.org/>

⁷ Physicians, NPs, PAs, DHs, and dentists are not required to be certified by Colorado state law.

| | Physician (MD, DO) ^{1, 2} | Nurse Practitioners ³ | Certified Nurse-Midwives | Certified Registered Nurse Anesthetists | Physician Assistant ⁴ | Dentist (DDS) ⁵ | Dental Hygienist ⁶ |
|-----------------------------------|--|--|--|---|---|--|---|
| Certification Requirements | <ul style="list-style-type: none"> 1) Completion of medical school 2) Pass board examination 3) Practice experience required by some boards | <ul style="list-style-type: none"> 1) Hold current RN license 2) Awarded a master's degree or higher in accredited specialty program 3) Completion of a minimum of 500 faculty supervised clinical hours in specialty | <ul style="list-style-type: none"> 1) Hold current RN license 2) Graduate of an accredited nurse-midwifery education program 3) Completion of one year of clinical training | <ul style="list-style-type: none"> 1) Hold current RN license 2) Graduate of an accredited nurse anesthesia education program | <ul style="list-style-type: none"> 1) Graduate from accredited program 2) Pass the Physician Assistant Certifying Examination (PANCE) 3) State licensure is not required for certification | <ul style="list-style-type: none"> 1) Graduation from an accredited dental school or completion of a GPR/AEGD program accredited by the Commission on Dental Accreditation 2) Hold a current state license 3) Completion of 1 of 3 different "Entry Point" options of post graduate professional experience and education 4) Passage of the American Board of General Dentistry exam | <ul style="list-style-type: none"> 1) Graduate from accredited education program 2) Pass the National Dental Hygiene Board Exam |
| Certification Renewal | Renewal required every 7 years | Renewal required every 5-7 years depending on specialty | Renewal required every two years | Renewal required every two years | Complete 100 hrs of CME every two years and sit for re-certification exam every six years | Renewal required every 5 years | No renewal required |

⁸ Certification of NPs is not mandated in Colorado

| | Physician (MD, DO) | APN (NP, CNM, CRNA) | Physician Assistant | Dentist (DDS) | Dental Hygienist |
|--|---|--|--|---|--|
| Undergraduate ⁹ | Baccalaureate degree. Pre-medicine requirements include science, humanities and mathematics. ¹⁰ | Bachelor of Science degree in Nursing (BSN). First two years include general study including nursing prerequisites; last two years include a combination of didactic and clinical courses. ¹¹ | Baccalaureate degree and health care experience. ¹² | Baccalaureate degree. Pre-dental requirements include science and humanities. ¹³ | Baccalaureate degree in dental hygiene. Combination of didactic and clinical coursework. ¹⁴ |
| Graduate | 4-year medical school. Combination of didactic coursework and clinical rotations. ¹⁵ | 2-year master's degree. Combined didactic and clinical training in chosen specialty. ¹⁶ As of 2008, Colorado requires graduate degree to register as an APN. ¹⁷ | OPTIONAL: 24-32 month Master's degree ¹⁸ with didactic coursework and clinical rotations. ¹⁹ | 4-year dental school. Combination of didactic coursework and clinical training. ²⁰ | NA |
| Residency (advanced clinical training in chosen field) | Family practice and pediatrics - 3 years OB/GYN and anesthesiology - 4 years *Additional years of residency required for subspecialties | NA | NA | NA | NA |

⁹ In this matrix, "undergraduate" is defined as a four year, baccalaureate degree. It should be noted that 2-year PA and DH accredited programs exist. In addition, preceding the requirement for a graduate degree, some APNs may have attained a license through a 2-year accredited program as well.

¹⁰ <http://www.uchsc.edu/som/admissions/requirements.htm>

¹¹ <http://www.nursing.ucdenver.edu/undergrad/bs.htm>

¹² <http://www.aapa.org/glance.html>

¹³ <http://www.adha.org/careerinfo/rdhedu.htm>

¹⁴ Ibid

¹⁵ <http://www.uchsc.edu/som/curriculum/>

¹⁶ <http://www.nursing.ucdenver.edu/pdf/MS%20COP%20Fall%202008.pdf>

¹⁷ <http://www.dora.state.co.us/nursing/statutes/NursePracticeAct.pdf>

¹⁸ <http://www.aapa.org/glance.html>

¹⁹ <http://www.uchsc.edu/sod/programs/dds/curriculum.htm>

²⁰ <http://www.uchsc.edu/sod/programs/dds/curriculum.htm>

Appendix H Evidence-Based Summaries

REGISTERED DENTAL HYGIENIST EVIDENCE-BASED SUMMARIES

Article

Freed James, Dorothy Perry and John Kushman. (1997). "Aspects of Quality of Dental Hygiene Care in Supervised and Unsupervised Practices." *Journal of Public Health Dentistry* 57 (2): 68-75.

Study Aims. To assess the effectiveness and quality of care provided by dental hygienists in unsupervised settings under the aegis of California's Health Manpower Pilot Project (HMPP) "Dental Hygiene Independent Practice Prototype." The HMPP sponsors experiments involving new or expanded roles for health care providers and derives its legal authority from state statute.

Study Methods. Hygienist findings were compared to six general dentist practices through chart reviews and administrative documents provided to a state agency and a private insurance company. The original study design was to compare the care provided by independent practice dental hygienists with dental practices located in the same Zip codes. Study sponsors at California State University Northridge were unable to recruit private dentists to participate in the study. The structure review included an evaluation of patient access, cleanliness and infection control procedures, radiation safety, procedures for after hours emergency care and the patient record systems, including patient recall. The process review was based on record reviews, interviews with DHs, dentists and office staff. The sole outcome measure, patient satisfaction with treatment, was measured through a questionnaire that distributed to the first 150 patients in each DH practice.

Sample Size. Nine dental hygienist practices with 15 hygienists participated in the study. A group of six California dentist practices that were being reviewed by one of the researchers contemporaneously were used to provide a comparison.

Data Collection and Analysis. Quality of care was evaluated in all six dental practices and seven of the hygienist practices. Patient satisfaction questionnaires were given to the first 150 new patients seen in the practice with a total of 686 questionnaires distributed to inquire about patient satisfaction. 225 dental hygienist records were reviewed. Information gathered by observations at sites, review of medical records systems and interviews with hygienists and staff at the dental offices.

Limitations. Potential performance bias (Hawthorn effect), that is, dentists and dental hygienists were aware they were being reviewed. Convenience sample of dentists: patient records were chosen by the purpose for which the practice was being reviewed

Summary of Findings

The structural review of the hygienist practices proved to be acceptable and even surpassed the dentist practices in most areas, including infection control. The independent dental hygiene practices had high percentages of acceptable care that were higher than dentists in follow-up medical findings (76.7% vs. 16.7%), updating medical histories (91.4% vs. 42.3%), and documenting evaluation of the periodontal status (87.1% vs. 61.7%) and soft tissues (89.4% vs. 29.9%). 98% of patients expressed satisfaction with their dental hygiene care.

Threats to Validity/Generalizability. Besides clinical safety, there is ambiguity of who the evaluators in the study were and whether they had the competency to review medical records. There were no

recognized standards for acceptable performance, so the study was not able to measure whether the hygienist practices or the dentist practices met overall standards.

Article

Freed James, Dorothy Perry, and John Kushman. (1997) "Characteristics of Patients Seeking Care from Independent Dental Hygienist Practices." *Journal of Public Health Dentistry* 57 (2): 76-81.

Study Aims. To assess the socio-demographic characteristics of patients who sought care from independent hygienists and their level of satisfaction and to document whether patients scheduled follow-up dentist visits.

Type of Study. This observational study was conducted between 1987-1990 when it was terminated because of a lawsuit brought by the California Dental Association.

Study Methods. Demographic information was collected at baseline as well as satisfaction after the first visit and 18 months after program participation. Follow-up surveys were sent to patients at 12 and 24 months following their initial visit to determine if they had scheduled a visit and seen a dentist.

Sample Size. 657 Startup Initial Visit Survey (SUIVS) questionnaires were distributed to patients and 463 were returned (response rate of 70.5%). 429 Established Practice Initial Visit Survey (EPIVS) questionnaires were distributed and 214 were returned (response rate of 49.9%).

Data Collection and Analysis. The SUIVS was given to new patients when the practice opened, and the EPIVS was given to new patients at least 18 months after the practice opened. The EPIVS was used to determine any change in patient demographics as the practices matured and to collect patient satisfaction. Satisfaction questions were added to the SUIVS for practices that began after the onset of the study. The surveys collected patient demographics, self-assessed oral health, and reason for dental hygiene visit, relationship with dentists, and knowledge of the independent practice setting. The demographic and dental health questions were based on questions used by the National Center for Health Statistics (NCHS) and the patients satisfaction questions were developed by the RAND Corporation.

Summary of Findings

Hygienists patients were largely women, white, attended some college and had a low-to-moderate family income. 98% were satisfied with their care; follow-up revealed over 80% visited a dentist within 12 months, a similar finding for patients that reported having regular dental visits before their initial visit to the hygienist and those who did not have a regular dentist prior to their participation in the study. For the follow-up studies, fewer responders were under 18 and fewer were nonwhite when compared to non-responders. In addition, it was found that as a practice matured, a larger portion of their patients were nonwhite and had lower incomes with the time since their last dental visit being greater.

Threats to Validity/Generalizability. Operating under a legal challenge that ultimately forced the practices to close, forced this study to end early limiting complete data collection. The dental hygienist may have been able to market services differently and potentially with more success without a legal environment acting as a barrier. Findings are generalizable to most populations.

Article

Kushman J, Perry D, and Freed J. (1996). "Practice Characteristics of Dental Hygienists Operating Independently of Dentist Supervision." *Journal of Dental Hygiene* 70(5): 194-205.

Study Purpose. To investigate the quality of care provided by independent practice dental hygienists (DHs), patient demographics, patient participation in the continuum of dental care, patient access to care and the business practices of the hygienists participating in the California Health Manpower Pilot Project (HMPP) study.

Type of Study. Observational pilot study implemented between 1987-1990.

Study Methods. After a period of training, dental hygienists were permitted to set up independent businesses to provide dental hygiene services allowed under general supervision as defined in California statute. The experiment was conducted under the auspices of the state's Health Manpower Pilot Project (HMPP) authority.

Sample Size. 16 DHs organized into ten independent detail hygiene practices.

Data Collection and Analysis. Data were collected on patient characteristics, types of services provided, patients' access to the full continuum of dental care, number of patient visits, fees charge, dentist referrals, number of Medicaid patients. The data reported in this paper represent 10 case studies of independent DHs. Data forms were tailored to the particular practice setting and included: total number of patient visits and services provided to new patients; services provided including teeth cleaning, fluoride treatment, root planing, sealants, bitewing radiographs, etc.; fees for each service and a monthly summary of fees. Comparative fees charged by dentists were solicited through a telephone survey to dentist offices. A telephone survey was conducted in January 1990 to determine whether, and to what extent, the DHs participating in the experiment accepted Medicaid patients. Data were also collected on institutionalized patients (i.e., nursing homes) but only between January and June 1988 because of environmental threats to the experiment.

Limitations. It is not clear whether data collection tools were uniform across the sites; data collection at some sites had to cease because of a pending lawsuit; a comparison group of practicing dentist was not realized because of opposition by California dentists to the experiment. The authors note the difficulty in comparing DH fee structure to that of a dentist because of the way the services are bundled in a dentist's office. 50 charts were randomly selected from the 10 DH office-based sites to examine referral rates, the results varied widely and small cells were a problem. Although the authors discuss the probability of skewed data resulting from small cell sizes, and the benefits of a case study design to probe for reasons, this should still be considered a limitation to interpreting these data.

Summary of Findings

A majority of the services provided were prophylaxis treatments. All practices attracted new patients over the study period and were developing strong referral relationships especially with residential care institutions. The HMPP 139 practices served clients from a variety of non-traditional organizations. Eight of the nine HMPP 139 practices accepted new Medicaid patients.

Threats to Validity/Generalizability. The researchers modified their study design due to the unwillingness of dentists to participate as comparison practice sites. This design modification resulted in the data collected for comparative purposes to be less than comparable, thus compromising the findings with regard to differential outcomes between DH practices with that of dentists.

Article

Astroth D and Cross-Poline G. (1998). "Pilot Study of Six Colorado Dental Hygiene Independent Practices." *Journal of Dental Hygiene* 72(1):13-22.

Study Aims. To assess the productivity and service mix in six Colorado independent dental hygienist practices for the purposes of comparing Colorado's experience with findings from the California Health Manpower Pilot Study.

Type of Study. Observational study involving a convenience sample of independently practicing dental hygienists in Colorado.

Study Methods. This pilot study used a convenience sample of independent dental hygiene practices because there was no mechanism in place to determine the total number of dental hygienists practicing independently or to require their participation. The 8-month study had three phases that gathered data through various surveys. Participants completed weekly surveys tracking performance of services and patient information.

Sample Size. Six independently practicing dental hygienists.

Data Collection and Analysis. A 21-item survey was distributed by mail to obtain demographic and practice information (phase 1). Over three months, weekly surveys were completed tracking patient visits and services provided (phase 2). A general office audit and an audit of 22 randomly selected patient records at each practice (n=132) to evaluate process was conducted to evaluate process and structure (phase 3). Investigators evaluated structure by adapting guidelines from the California HMPP 139 study.

Limitations. Convenience sample, self reporting bias, lack of operational definitions of medical/health history, extra/intra-oral examination, periodontal probing and dental charting on weekly forms.

Summary of Findings

Dental hygienists had practiced on average for 13 years before establishing an independent practice. Four were office-based, one was institution-based and one was office and institution-based. General office audits revealed compliance with infection control, office protocols for emergency situations and practice management protocols. Patient record audits found high standards were employed for process of care measures observed.

Threats to Validity/Generalizability. Findings could not be generalized to all Colorado dental hygiene independent practices since it was estimated that the study sample was only one-third of all independent hygienists practicing in Colorado at the time. A larger sample size and a comparison group would have increased the overall generalizability of the study.

Article

Sanzi-Schaedal S, Bruerd B, and Empey G. (2001). "Building Community Support for a School Dental Sealant Program." *The Journal of Dental Hygiene* 75(4): 305-309.

Study Aims. To implement a school-based dental sealant program in Multnomah County, Oregon.

Type of Study. Observational community-based intervention.

Study Methods. The Multnomah County, Oregon sealant program involved local volunteer dentists who conducted dental screenings. The program began in 1989 and targeted elementary schools with 40% or more students in free or reduced-cost lunch programs. Teachers distributed permission slips to be signed by a guardian, authorizing that the child could participate in the program. The dental sealant program was offered to all children in the eligible schools. The sealants were placed by teams consisting of a dental hygienist and dental assistant who were paid staff of the Dental Division of the Multnomah

County Health Department. During the screening, dentists assigned each child with a treatment needs category, evaluated the need for dental sealants, provided authorization for sealants and evaluated the sealants placed during the previous year.

Sample Size. 5,252 second and third grade students in 64 schools or community-based programs such as a sports camp for low-income children. A total of 11,087 dental sealants were placed on 3,866 children.

Data Collection and Analysis. Indicators of success included the percentage of children who returned permission slips, the percentage of parents who gave permission, the number of children who received dental sealants and the one-year retention rate of the dental sealants placed by the program staff.

Limitations. No participant or provider demographics, no comparison to students not participating.

Summary of Findings

59-65% of children eligible for the program obtained necessary permission from a guardian to participate. The proportion of children returning permission slips remained constant at about 75-80%. The overall number of children receiving dental sealants increased as resources allowed the program to add new schools. From 1990-91 to 1997-98, the median retention of dental sealants increased from 71% to 94%. Participating schools reached the Health People 2010 objective of 50% of 8-year-olds having at least one dental sealant. In 1997-98, at least 54% of the screened third-graders had at least one intact dental sealant. All participating dentists stated that they "strongly agreed" or "agreed" to all questions on an evaluation survey that asked whether placed sealants were of good quality.

Threats to Validity/Generalizability. Because this study was community-specific it may not be generalizable to other communities.

Study Characteristics

| Study | Freed et al., 1996 |
|-----------------------------------|--|
| Methods | Observational pilot study |
| Setting | Independent dental hygiene practices in California |
| Participation/sample size | 9 dental hygienist practices with 15 dental hygienists. Six dental practices were used for a comparison sample |
| Outcomes | Structure of practices and process of care |
| Limitations/Bias/Generalizability | Performance bias, convenience sample of dentists, ambiguity of who the reviewers were, no recognized standards of records of performance, early termination of study |
| Recommended Rating | Fair |

| Study | Perry et al., 1996 |
|---------------------------|--|
| Methods | Observational pilot study |
| Setting | Independent dental hygiene practices in California |
| Participation/sample size | 657 Startup Initial Visit Surveys (SUIVS) were distributed, 463 were returned for a response rate of 70.5%. 429 Established Practice Initial Visit Surveys (EPIVS) were distributed, 214 were returned for a response rate of 49.9%. |
| Outcomes | Use of dental services and patient satisfaction. |

| | |
|-----------------------------------|--|
| Limitations/Bias/Generalizability | Self-report bias, premature closing of study, project resources did not allow for non-response analysis for the initial visit surveys and early termination of study. Dentists in the same geographical area as the dental hygiene practices were unwilling to participate in the study. |
| Recommended Rating | Fair |

| | |
|-----------------------------------|--|
| Study | Kushman et al., 1996 |
| Methods | Observational pilot study |
| Setting | Independent dental hygiene practices in California |
| Participation/sample size | 16 DHs organized into ten independent detail hygiene practices |
| Outcomes | Number of patients seen, service mix, service fees, referral sources, access to care and practice characteristics. |
| Limitations/Bias/Generalizability | Self-report bias, premature closing of study, project resources did not allow for non-response analysis for the initial visit surveys and early termination of study. Dentists in the same geographical area as the dental hygiene practices were unwilling to participate in the study. |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Astroth et al., 1998 |
| Methods | Observational study involving a convenience sample |
| Setting | Independent dental hygienists in Colorado |
| Participation/sample size | Six independent dental hygienist practices in Colorado |
| Outcomes | Productivity and service mix |
| Limitations/Bias/Generalizability | Convenience sample, self-report bias, lack of operational definitions |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Sanzi-Schaedal et al., 2001 |
| Methods | Community Based Intervention |
| Setting | Multnomah, Oregon in elementary schools and other community programs |
| Participation/sample size | 5252 second and third grade students in 64 schools and other community programs. A total of 11087 dental sealants were placed on 3866 children. |
| Outcomes | Percentage of children who returned a permission slip, percentage of parents who gave permission, the number of children who received dental sealants and the one-year retention rate of the dental sealants placed by program staff. |
| Limitations/Bias/Generalizability | No participant or provider demographics, no comparison to students not participating. The lack of data restricts the ability of this study to be analyzed and applied elsewhere. |
| Recommended Rating | Fair |

ADVANCE PRACTICE NURSE EVIDENCE-BASED SUMMARIES

Article

Lenaway D, Koepsell T, Vaughan T, Belle G, Kirkwood S and Cruz-Uribe F. (1998). "Evaluation of a Public-Private Certified Nurse-Midwife Maternity Program for Indigent Women." *American Journal of Public Health* 88(4): 675-79.

Study Aims. To evaluate a countywide public health CNM program where CNMs were the principal providers of prenatal, delivery and post-partum care for low-income medically indigent women. The study was designed to assess the CNMs ability to impact access to prenatal care, reducing antepartum complications and achieving positive birth outcomes.

Type of Study. Population-based quasi-experimental design.

Study Methods. The study compared the intervention county (countywide public health CNM program) with two non-intervention comparison counties (A and B). These two counties were adjacent to the intervention county and had no communitywide intervention involving low-income pregnant women. All women in the target population who resided in the three study counties and delivered a live-born singleton infant between Sept. 1989 and December 31, 1990 were included in the study.

Sample Size. 692 eligible births were identified in the intervention county and 726 and 1,373 respectively in the two comparison counties.

Comparison Group. The intervention group was comparable to indigent pregnant women in the two adjacent counties based on socio-demographic characteristics including: maternal age, race, education, marital status, employment during pregnancy, and tobacco and alcohol use during pregnancy. Differences were found between the counties in maternal education, alcohol use during pregnancy and race/ethnicity.

Data Collections and Analysis. The primary source of data was birth certificates from the Vital Statistics Section of the Colorado Department of Public Health and Environment. The state Medicaid and indigent care programs provided lists of participants to link to birth certificates. A modified version of the Kessner index was used to assess adequacy of prenatal care using a dichotomous variable: adequate versus less than adequate prenatal care. Pregnancy-related outcomes included complications from anemia, pregnancy-induced hypertension, and gestational diabetes. Birth outcomes included gestational age, 5-minute Apgar score cutoff of 8 and birth weight. A logistic-binomial random-effects regression model was used to estimate crude and adjusted odds ratios and their associated confidence intervals. The random effects model assumed that comparison counties could be assumed a random sample of all possible counties available to be studied.

Limitations. The primary source of data was birth certificates which are known to have less than accurate data on complications related to pregnancy and the various procedures used during the birth process. Limiting the comparison group to two counties increased the probability of a Type II error. Not having good baseline data also was considered a limitation by the authors but funding constraints was a limiting factor.

Summary of Findings

- CNMs were the principal delivery attendant for intervention group (60.1% vs. 10.3% for county A and 3.9% for county B).

- The proportion of women who received no prenatal care was significantly lower in the intervention county than in the control counties. A comparison of late or no prenatal care found nearly equivalent proportions among intervention and comparison county women.
- The proportion of women who received adequate prenatal care among the intervention population was significantly higher than among those in the comparison counties (52.5% versus 44.6%).
- The risk of developing anemia was lower among the intervention group while pregnancy-induced hypertension was found to be elevated among women from the intervention county. No significant difference was found between groups for gestational diabetes.
- Newborns from the intervention group were less likely to have a low Apgar score at 5 minutes after birth (11.1% vs. 20.7%)
- The proportion of Cesarean section deliveries among intervention and comparison groups was nearly identical, although women who reported a C-Section for a previous birth had a higher proportion of vaginal births at current delivery in the intervention group.
- The incidence of premature birth was lower among women from the intervention group than the comparison group, but the difference was not statistically significant.
- Low-weight births were fewer in the intervention group but the finding was not quite statistically significant. The proportions differed between interventions and comparison counties by 7.1% and 9.4% respectively.

Threats to Validity/Generalizability. Small sample of counties used for comparison increased likelihood for Type II error and reduced statistical power.

The authors noted that the study mimicked an "intention-to-treat" approach by including all eligible women regardless of whether they saw a CNM or a physician thus reducing an otherwise threat to the validity of the findings, i.e., selection bias.

Article

Mundinger M, Kane R, Lenz E, et al. (2000). "Primary Care Outcomes in Patients Treated by Nurse Practitioners or Physicians: A Randomized Trial." *JAMA* 283: 59-68.

Study Aims. To compare outcomes for patients randomly assigned to nurse practitioners or physicians for primary care follow-up and ongoing care after an emergency department or urgent care visit.

Type of Study. Randomized controlled trial.

Study Methods. Conducted between August 1995 and October 1997 patients were recruited for the study from an urgent care center and 2 emergency departments that were affiliated with a medical center. Patients were randomly and blindly assigned to a NP or a physician. After an initial visit, patients were considered a part of the provider's panel. Enrollment goals were based on a sample size needed to detect a difference of 5 points on a 100 point scale on the SF-36 health status questionnaire.

Sample Size. Of the 1,981 patients that were randomly assigned, 1,316 patients kept their first scheduled appointment and were considered enrolled in the study NP (n=806) or physician (n=510).

Data Collection. Baseline demographics were collected and the SF-36 was administered at randomization, again following enrollment and at 6 months after enrollment. A 12-item satisfaction survey was administered after the first visit and again at 6 months. The SF 36 is a self-reported measure of health status. Physiologic tests were administered to patients with certain chronic illnesses. Health care utilization was tracked from 6 months prior to enrollment, 6 and 12 months after enrollment.

Limitations. Patients could not be randomized at the point of initial contact due to a timing and location gap. There was a significant difference in attrition between NPs and physicians, although the loss was prior to receiving care (i.e., enrollment). A one-year follow-up of the SF-36 was not done but in retrospect would have added power to the findings. Generalizability was limited since it was conducted in academic medical center-affiliated community-based primary care clinics. Providers were university faculty and the patients were predominantly immigrants from the Dominican Republic who were eligible for Medicaid.

Summary of Findings

No significant difference was found in patients' health status at 6 months between NPs and physicians. Patients with hypertension had diastolic values that were statistically significantly lower for NP patients (82 vs. 85 mm Hg). No significant differences in health services utilization after either 6 months or one year nor were differences found in satisfaction ratings after initial appointment. At 6 months, satisfaction ratings differed for 1 of 4 provider attributes for those NPs whose office was relocated mid-study (physicians rated higher 4.2 vs. 4.1 where 5 was excellent). There was no difference for NPs who did not move. The hypothesis predicting similar patient outcomes between the two provider groups was strongly supported by the findings of no significant differences in SF-36 scores, 2 of 3 physiologic measures, health services utilization at 6 and 12 months and all but one satisfaction score.

Threats to Validity/Generalizability. Patients that were randomly assigned but did not keep their first appointment were significantly different: enrolled patients were older, more were female and Hispanic, more chronic diseases were reported and they needed to wait fewer days for their follow-up appointment. There were no threats from selection bias observed between the two groups demographically, health status or utilization patterns. The patient population was not representative of the general population in that it was predominately Spanish-speaking immigrants but it could be generalized to a like population of low-income immigrants.

Article

Mundinger M, Kane R, Lenz E, et al. (2004). "Primary Care Outcomes in Patients Treated by Nurse Practitioners or Physicians: Two-year Follow-Up." *Medical Care Research and Review* 61: 332-351.

Study Aims. To collect 2-year follow-up data from Phase I study participants (Phase one was reported in 2000).

Type of Study. Randomized controlled trial.

Study Methods. The initial study was conducted between August 1995 and October 1997 where patients were recruited for the study from an urgent care center and 2 emergency departments that were affiliated with a medical center. Patients were randomly and blindly assigned to a NP or a physician. An attempt was made to contact all of the eligible participants. Patients who had crossed over from one primary care provider to another were eliminated from the analysis.

Sample Size. 406 patients were eligible for analysis since they received primary care from the originally assigned practice and made at least one follow-up visit to that practice during the two years after the initial visit.

Data Collection. Demographics and baseline summary SF-36 scores were compared before administered a follow-up SF-36 and Primary Care Assessment Survey to measure patient satisfaction. Bilingual interviewers conducted the surveys and bilingual nurses measured primary functions such as blood pressure and drew blood. The medical center provided billing data for patient use of primary, specialist, emergency room and hospital care for the 2-year period.

Limitations. Generalizability was limited since it was conducted in academic medical center affiliated community-based primary care clinics. Providers were university faculty and the patients were predominantly immigrants from the Dominican Republic and enrolled in Medicaid. Patient satisfaction was limited to those who received primary care during year two creating a smaller sample size of 217.

Summary of Findings

Consistent with the findings of Phase I, there were no statistically significant differences between nurse practitioners' and physicians' patients nor were there any significant differences in overall satisfaction between providers. Patients did not differ in their use of specialist, emergency rooms, or inpatient hospital services. However, physician patients had higher primary care utilization than nurse practitioner patients. This was attributed to a larger percentage of NPs had no primary care visits during year two and more physician patients had five or more visits.

Threats to Validity/Generalizability. Patients who sought primary care from another provider than was originally assigned differed from those who were eligible for follow-up analysis: enrolled patients were older, more were female, had more chronic diseases and were more likely to be on Medicaid. The patient population was not representative of the general population in that it was predominately Spanish-speaking immigrants but it could be generalized to a like population of low-income immigrants.

Article

Ohman-Strickland, P. et al. (2008). "Quality of Diabetes Care in Family Medicine Practices: Influence of NPs and PAs." *Annals of Family Medicine* 6(1):14-22.

Study Aims. To assess whether the quality of diabetes care differed among practices employing NPs, PAs, or neither and whether practice attributes contributed to differences observed in processes and outcomes of care. This study examined the dynamics of team versus non-team based practices.

Type of Study. Cross-sectional analysis of baseline secondary data from a quality improvement trial in 46 non-residency family medicine practices participating in ULTRA (Using Learning Teams for Reflective Adaptation), a group randomized intervention study.

Study Methods. Cross-sectional study of 46 family medicine practices from New Jersey and Pennsylvania. 28 practices did not employ an NP or PA, 9 practices employed one or more PAs and 9 practices employed one or more NPs. Basic information about office practice was collected from the office manager or physician using a standardized form. 846 patient charts audits were conducted by nurse auditors to assess adherence to American Diabetes Association diabetes guidelines. Logistic regression analysis determined differences between practices with and without NPs and PAs.

Sample Size. 46 family medicine practices: 28 had neither a PA nor an NP on staff, 9 practices had 1 or more PAs and 9 practices had 1 or more NPs. Two practices that had both PAs and NPs were excluded.

Data Collection. Baseline data were collected from 46 nonresidency family medicine practices participating in ULTRA (Using Teams for Reflective Adaptation), a group randomized intervention study. Audits from medical records assessed adherence to guidelines for diabetes care using the clinical practice guidelines of the American Diabetes Association (ADA). Practice managers or lead physician completed a questionnaire to categorize practice characteristics. Staff members then completed a 20-minute self-administered questionnaire that assessed the practice's staff participation in decision-making.

Limitations. Relatively small number of practices that employed NPs and PAs. Small sample sizes and missing data affected the researcher's ability to detect significant differences in the process of patient care or organizational characteristics. Patient socioeconomic and demographic characteristics were not collected and they could have been confounding influences to explain findings. The study may not be generalizable to other small family medicine practices because findings focused on average trends across practices rather than highlighting unique characteristics of individual practices.

Summary of Findings

The three practice types were compared. Comparison of practices w/ NPs vs. practices w/ PAs found that NPs were almost twice as likely to assess HbA_{1c} levels, were more likely to assess lipid levels (80% vs. 58%) and were 5 times more likely to assess microalbumin levels than PAs. NPs were 37% more likely to meet treatment guidelines for lipids and were 45% more likely to have patients attain lipid targets. Comparison of practices w/ NPs vs. practices with physicians only found NPs were more likely to assess HbA_{1c} levels (66% vs. 49%) and also more likely to assess lipid levels than physicians (80% vs. 68%), these differences were both statistically significant. The final comparison was between practices w/ PAs vs. physicians only. PAs were 67% less likely to assess microalbumin levels, PAs were also less likely to assess HbA_{1c} and lipid levels but the differences were not statistically significant. The authors concluded that practices employing NPs significantly outperformed all other practice types studied.

Threats to Validity/Generalizability. The study assessed the overall effects of team-based practices in treatment of patients with a chronic health condition.

Article

Venning P, Durie A, Roland M, Roberts C and Leese C. (2000). "Randomised Controlled Trial Comparing Cost Effectiveness of General Practitioners and Nurse Practitioners in Primary Care." *BMJ* 320: 1048-1053.

Study Aims. To compare the process, outcomes and cost of care provided by general practitioners and nurse practitioners requesting a same day appointment in 20 general practices.

Type of Study. Multi-center randomized controlled trial conducted in 20 general practices in England and Wales.

Study Methods. 20 geographically dispersed general medicine practices that employed a nurse practitioner agreed to participate in an experiment that randomly assigned patient requesting a same day appointment to a physician or nurse practitioner for the visit.

Sample Size. 1,316 of 1,716 eligible patients were randomized (77%). Due to attrition and missing data, 1,292 patients were included in the analysis—665 general practitioner consultations and 641 nurse practitioner visits.

Data Collection. Details of the patient visit were extracted from medical records, time per visit was recorded with an electronic time stamp and patients completed the SF-36 health status questionnaire and a medical interview satisfaction scale or the pediatric version of the scale if the patient was a child.

Limitations. Study was designed to only enroll patients calling for a same day appointment, therefore the patients were not typical of a general practitioners' patient mix.

Summary of Findings

NP spent more face-to-face time with patients (11.57 vs. 7.28 minutes); there was no significant difference between NPs and physicians in the number of patients that had a physical exam; NPs wrote fewer prescriptions than physicians but the difference was not significant; NPs ordered more tests and investigations (opportunistic screenings) than physicians (8.7% vs. 5.6%) and were significantly more likely to suggest the patient schedule a return visit (37.2% vs. 24.8%). Patients reported higher levels of satisfaction with the NP visit, scores on the overall medical interview scale and all its subscales were significantly higher. Health services costs associated with an NP visit were 12.5% lower than those for a general practitioner, the difference was not significant.

Threats to Validity/Generalizability. Because the randomization took place in a same day appointment context, the findings are not necessarily generalizable to other patient visit contexts. NPs were working as part of a practice team and not independently, therefore the results may not be generalizable to independent practice NPs.

Article

Litaker D, Mion L, Planavsky L, Kippes C, Mehta N, Frolkis J. (2003). "Physician-Nurse Practitioner Teams in Chronic Disease Management: The Impact on Costs, Clinical Effectiveness, and Patients' Perception of Care." *Journal of Interprofessional Care* 17 (3): 223-234.

Study Aims. To assess selected process of care measures and outcomes associated with a chronic disease management program (hypertension and diabetes), clinical practice algorithms, patient education

and regular monitoring and feedback by a nurse practitioner-physician team compared to a traditional physician-only practice.

Type of Study. Randomized control trial with 157 patients randomly assigned to one of two practice approaches, i.e., a nurse practitioner-physician team (n=79) and a physician-only practice (n=78).

Study Methods. Study conducted at a large teaching hospital outpatient clinic where patients were randomly assigned to either a team consisting of a primary care physician and nurse practitioner or a primary care physician alone. Patients were previously diagnosed with mild or moderate hypertension and non-insulin dependent diabetes mellitus without known complications. In the team-based model, NPs served as the first point of contact for care. Treatment outcomes, satisfaction with care, and patients' perceptions of care for diabetes mellitus and hypertension were measured through various instruments. Patients were enrolled for 12-months from 10/1996-1/1998.

Sample Size. Of the 1,717 potential subjects, 157 patients with hypertension and diabetes mellitus were randomly assigned either to the intervention team or the control group of their regular primary care physician.

Data Collection. Process and quality were measured through documented annual ophthalmologic and foot exams, HbA1c assessment at least once during the study year and influenza and pneumococcal vaccination status. Health care education was measured through documented discussions on medication adherence, side-effects, signs and symptoms of hyper-and hypoglycemia, effect of routine exercise, weight control, moderation in alcohol consumption, reducing dietary sodium intake, and smoking cessation when appropriate. Baseline and 12-month data were collected. Outcomes were measured by clinical observation; patient perceptions of health-related quality of life (HRQoL) and satisfaction with care were measured using the SF-12 and the Diabetes Quality of Life questionnaire. Patients considered medically complex were excluded from the study as were patients taking three or more medications for blood pressure control. To obtain estimates for personnel costs associated with each encounter, service level and provider-specific time estimates were multiplied by the provider salary and billing data were used to confirm personnel costs.

Limitations. Small sample size in each group and short time frame to assess impacts deriving from each of the two models.

Summary of Findings

Patients assigned to the intervention and control groups did not differ significantly on demographics, health status or baseline measures associated with heart disease and diabetes at entry into the program. The nurse practitioner/physician team received significantly higher scores for all aspects of preventive care and education (for 7 of 11 indicators the team scored 100%). Team-treated patients also had increased HDL-c levels and a small but significant improvement in long-term diabetes control as reflected in decreased HbA1c levels. Patients assigned to the NP/MD team had an average contact time of 180 minutes throughout the year of the study as opposed to 85 minutes in the physician-only practice. Change from baseline satisfaction with care was significantly higher for patients seen by the NP/MD team (+6.2 vs. -1.7). Other sub-scale measures included: communication with provider (+3.9 vs. -3.0) and interpersonal care (+4.4 vs. +1.9). In the NP/MD team, physicians contributed to the care of 216 or 40 percent of patient visits. Costs were higher in the NP/MD team—\$134.68 compared to \$98.70 for the physician-only practice. It was observed that the positive outcomes achieved by team management of diabetes were lost within 12 months following study disenrollment. A post-hoc analysis of 103 (66%) study participants' HbA1c values revealed a rapid return to pre-enrollment values for patients seen by the NP/MD team.

Threats to Validity/Generalizability. Although the study design was appropriate to the research question, the sample size was too small and the statistical power insufficient to provide conclusive evidence of differences between the two practice styles.

Article

Roblin D, Howard D, Becker E, Adams E and Roberts M. (2004). "Use of Midlevel Practitioners to Achieve Labor Cost Savings in the Primary Care Practice of an MCO." *Health Care Economics* 39 (3): 607-625.

Study Aims. To estimate the savings in labor costs per primary care visit that might be realized from an increased use of physician assistants (PAs) and nurse practitioners (NPs) in the primary care practices of a managed care organization (MCO).

Type of Study. Observational analysis of computerized visit records and payroll ledgers over a three-year period.

Study Methods. The likelihood of a visit attended by an NP or PA was modeled using logistic regression, practice effects were fixed in the model and included department (adult medicine or pediatrics). Models were estimated separately by year. The dependent variable was whether a NP/PA attended the visit. The study included visit and payroll data from 26 capitated primary care practices of a group model HMO. Data on approximately 2 million visits provided by 206 practitioners for 1997-2000 were extracted for the analysis.

Sample Size. Two million patient records for 1997-2000 representing approximately 275,000 members.

Data Collection. Computerized patient visits (completed at the time of visit containing patient history, attending practitioners and ICD-9-CM codes); computerized enrollment forms containing patient demographics and computerized timesheets and payroll ledgers were used to analyze labor costs. Analysis was performed on the association between extent of use of PAs and NPs in primary care delivery and visit labor costs adjusting for patient case mix. A three-step model was used. The principal hypothesis was that average annual labor costs per visit would significantly vary with the propensity of a practice to use PAs and NPs.

Limitations. Limited generalizability due to the practice model, a fully capitated HMO. Estimates of costs savings used a linear model which may not be a realistic assumption.

Summary of Findings

PA/NPs attended 32.4% adult medicine visits and 18.5% pediatric visits. Younger patients were much more likely than older patients to have an PA/NP visit; variations in the use of NPs/PAs in care delivery was a consequence of their level of employment in a practice, a higher proportion of PAs/NPs was positively correlated with visit as a percent of practice visits. Labor costs per primary visit averaged \$24 for practitioner labor and \$36 for total labor per practice year in adult medicine; labor costs in pediatrics were higher. When adjusting for patient case mix, practices that used NPs/PAs more extensively had significantly lower average practitioner labor costs. In this HMO, PAs/NPs were compensated at approximately 50 percent of an internist physician.

Threats to Validity/Generalizability. Findings from this analysis cannot be generalized to most primary care practices as the practice model is that of a closed panel HMO that is fully capitated and therefore has the ability to organize primary care in a more deliberate and cost-effective manner.

Article

Grumbach K, Hart L, Mertz E, Coffman J and L Palazzo. (2003). "Who is Caring for the Underserved? A Comparison of Primary Care Physicians and Nonphysician Clinicians in California and Washington." *Annals of Family Medicine* 1(2): 97-104.

Study Aims. To compare the geographic distribution and patient populations of physicians and non-physician primary care clinicians.

Type of Study. Observational, cross-sectional analysis of administrative and survey data.

Study Methods. This study was an analysis of administrative and survey data about primary care clinicians (family physicians, general internists, general pediatricians, nurse practitioners, physician assistants and certified nurse midwives) in California and Washington. Geographic and patient population outcomes were examined. Geographic outcomes were practice in a rural area, practice with a vulnerable population or practice in a health professions shortage area (HPSA). Patient population outcomes included the proportion of Medicaid, uninsured and minority patients seen in the practice.

Sample Size. 33,673 clinicians included in the analysis.

Data Collection. 1998 administrative and survey data about primary care physicians in CA and WA were obtained from the American Medical Association Physician Masterfile. The analysis was restricted to physicians active in patient care, not in training and with a primary self-reported specialty of family medicine (including general practice), internal medicine, pediatrics and OB/GYN. Data for non-physician primary care providers were gathered from a 1998 mail survey (CNMs were not surveyed in WA). Clinicians' main practice addresses were geo-coded and participating providers were assigned to service areas. Underserved areas were classified as rural community, area was a vulnerable population community or the area was designated as a primary care health professions shortage area (HPSA).

Limitations. The non-physician databases were less reliable than the AMA's Physician Masterfile. PAs and NPs may be more likely to value caring for vulnerable populations resulting in item response bias which overestimates Medicaid, number of uninsured patients and minority patients.

Summary of Findings

PA ranked first and second for each state for percent working in rural areas and HPSAs. In CA, PAs also had the greatest proportion of their members working in vulnerable population areas. Compared to physicians, NPs and CNMs (CA only) tended to have a greater proportion working in rural areas and HPSAs. Family physicians were much more likely than other types of primary care physicians to work in a rural area or HPSA. Non-physician clinicians in CA had a substantially greater proportion of Medicaid, uninsured, and minority patients in their practices.

Threats to Validity/Generalizability. May not be generalizable due to differences in the orientation of PA and NP training programs across the states.

Article

Horrocks S, Anderson E and Salisbury C. (2002). "Systematic Review of Whether Nurse Practitioners Working in Primary Care Can Provide Equivalent Care to Doctors." *BMJ* 324 (2002): 819-823.

Study Aims. To determine whether nurse practitioners can provide care at first point of contact equivalent to doctors in a primary care setting.

Type of Study. Systematic review of randomized controlled trials and prospective observational studies.

Study Methods. Included studies were randomized controlled studies and prospective observational studies comparing NPs and physicians providing care at first point of contact for patients with undifferentiated health problems in a primary care setting and providing data on one or more of the following outcomes: patient satisfaction, health status, costs or process of care measures.

Sample Size. 11 trials and 23 observational studies.

Data Collection. Cochrane controlled trials register, specialist register of trials maintained by Cochrane Effective Practice and Organization of Care Group, Medline, Embase, CINAHL, science citation index, national research register, hand searches, and published bibliographies. The Cochrane optimal search strategy was used with advice from university librarians.

Limitations. Ambiguity around use of the term "nurse practitioner" resulted in a broad definition. Limited by the quality of available studies: few recent RCTs, larger number of observational studies of poor quality. Heterogeneity between studies in terms of setting, training and period of time. Only five studies provided data on costs and economic impact of NPs as substitutes for general practitioners.

Summary of Findings

Patients were more satisfied with care by an NP with no difference found in health status. NPs had longer patient visits than physicians and ordered more tests. NPs had more complete records and scored better on communications (offered more advice on self-care and management) than did physicians. No differences were found in prescribing medications, scheduling return consultations or referrals to specialists. The review concluded that quality of care provided by NPs was at least as good, if not better, than that provided by physicians.

Threats to Validity/Generalizability. The review casted a wide net in terms of use of the term "nurse practitioner." Because the studies reviewed were so heterogeneous, it is possible that the specific process of care, outcomes and satisfaction measures evaluated in a particular study or group of studies were more site or population specific and therefore not generalizable to all primary care practices.

Article

Hamric AB, Lindebak S, Worley D, and Jaubert S. (1998). "Outcomes Associated with Advanced Nursing Practice Prescriptive Authority." *Journal of the American Academy of Nurse Practitioners* 10(3): 113-16.

Study Aims. To assess whether APNs can safely and effectively prescribe medications to acutely and chronically ill patients in a variety of ambulatory care settings.

Type of Study. Legislatively authorized state demonstration project.

Study Methods. To participate, APNs needed to meet specific requirements regarding licensure, past experience, collaborating agreements and be practicing in a medically underserved area. Of 44 completed applications, 35 APNs were approved, 2 withdrew, leaving 33 in the study in 25 different locations around the state. For each APN a physician was identified as collaborators with a formal practice agreement.

Sample Size. 33 APN primary care providers (including NPs, CNMs and certified nurse specialists) and 1,708 patients participated in the 2-month project. The majority of participating clinics were in rural areas (47%) or urban indigent clinics (15%).

Data Collection/Analysis. Data were recorded by the APN onto the patients' charts and co-signed by the collaborating physician. Each patient record contained demographic information, diagnosis, protocol selection, treatment plan, and prescriptions written and recommended follow-up. Patient satisfaction information was solicited through two survey forms. Physician data were collected at the end of the 2-month period. Site visits were conducted to corroborate chart data, adherence to protocols and patient satisfaction.

Limitations. Nurse recruitment method was a convenience sample. Small sample of nurses. Outcome measures which were summary statements such as "worsened" "unchanged" "stabilized" etc. were subjective and received criticism. Potential for selection bias because neither the APNs nor their collaborating physicians were randomly selected but rather volunteered to participate in the study. However, participating NPs were compared to all other NPs in the state and no significant differences were found in years of practice, level of education and certification status. Collaborating physician profiles were not assessed.

Summary of Findings

Forty percent of patients were covered by Medicare/ Medicaid with only 18 percent covered by private insurance. Most patients were white and female with a mean age of 30. The most common diagnoses made by APNs were respiratory tract disorders, reflecting the time of year the study was conducted. Ninety percent of patients received a prescription (2,889 prescriptions), based on the judgment of the APN and her/his collaborating physician. Physicians were consulted by APNs in 11 percent of cases, mostly to discuss a diagnostic test, have the physician read a chest x-ray or to discuss the advisability of a referral. 76 percent of patients either improved or stabilized in response to APN treatment; 40 percent of the remaining 24 percent were patients living with HIV or AIDS. Ninety-six percent of patients were satisfied with the care provided by their APN. Physicians reported strong agreement with APN prescribing practices and all physicians agreed that the demonstration project was beneficial to their patients.

Threats to Validity/Generalizability. No comparison group, convenience sample, very short study period; outcome measures subjective and broadly defined.

Article

Laurant M, Reeves D, Hermens R, Braspenning J, Grol, R and Sibbald B. (2004). "Substitution of Doctors by Nurses in Primary Care." *Cochrane Database of Systematic Reviews* Issue 4, ARTICLE #CD001271.

Study Aims. To evaluate the impact of doctor-nurse substitution in primary care on patient outcomes, process of care, and resource utilization including cost. Patient outcomes included morbidity, mortality, satisfaction, compliance and preference. Process of care included: adherence to clinical guidelines, standards/quality of care and health care activity. Resource utilization included frequency and length of visits, return visits, prescriptions, tests and investigations, referrals and direct and indirect costs.

Type of Studies Reviewed. Systematic review of randomized control trials, controlled before and after studies and interrupted time series.

Study Methods. For the period covering 1966-2002, the following databases were searched: Medline, Cinahl, Bids, Embase, Social Science Citation Index; British Nursing Index; HMIC; EPOC Register and Cochrane Controlled Trial Register. Search terms specified setting, professional, study design, and subject. Studies were included if nurses (NP, CNS and APN) were compared to physicians (general practitioners, family medicine, pediatricians general internists and geriatricians) providing similar primary care services.

Sample Size. 4253 articles were screened of which 25 articles relating to 16 studies met the inclusion criteria.

Data Collection/Analysis. Selection and data extraction was conducted independently by two reviewers with differences resolved through discussion. Meta-analysis was applied to outcomes for which there was adequate reporting of intervention effects from at least three RCTs. Semi-quantitative methods were used to synthesize other outcomes.

Limitations. Individual studies had a number of limitations including small sample sizes which resulted in an inability to assess the equivalence (not only difference) between nurses and physicians. In most cases, caseload was not measured so productivity could not be assessed. Few studies addressed the level of training for the specific role under investigation. In general, a narrow range of nurse roles that have been subjected to rigorous evaluation.

Summary of Findings

No appreciable difference could be found between physicians and nurses in health outcomes for patients, process of care, resource utilization or cost. Patient health outcomes were similar but satisfaction was higher with nurse primary care practitioners. Nurses tended to provide longer consultations, give more information to patients and follow-up with patients on a more frequent basis. Impact on physician workload and direct costs were variable across studies.

Threats to Validity/Generalizability. In general, threats to validity and generalizability were found to some degree in most of the individual studies examined. The methodological quality of the studies was variable. Future studies should seek to increase the number of practitioners rather than the number of patients to reduce the effect of an individual practitioner on observed outcomes.

Article

Laurant M, Hermens R, Braspenning, R Akkermans, B Sibbald, and Grol R. (2008). "An Overview of Patients' Preference for, and Satisfaction with, Care Provided by General Practitioners and Nurse Practitioners." *Journal of Clinical Nursing* 17: 2690-98.

Study Aims. To assess patient's views on the care provided by nurse practitioners compared with that provided by general practitioners and to determine the factors that are influencing these views.

Type of Study. Cross-sectional survey, observational study.

Study Methods. Patients who received care from both nurse practitioners and general physicians were randomly sent a self-administered questionnaire. Twenty months after the introduction of 20 NPs into a general practice, satisfaction questionnaires were sent to a random sample of 770 patients. Patients were stratified by NP and type of disease (largely asthma and COPD). The main factors being measured were patient preferences, satisfaction with their nurse or physician provider and factors influencing patients' preference and satisfaction.

Sample Size. Sample was drawn from 770 patients who were referred to an NP. In total 235 patients were selected to receive a questionnaire. Of these, 117 completed the questionnaire (response rate 50%).

Data Collection/Analysis. The patient questionnaire consisted of three domains: 1) preference with regard to different aspects of care, such as discussing complaints and emotional problems, education about disease and self-care, referrals to other providers, etc.; 2) satisfaction with different aspects of

care such as continuity, relationships and communication and support; and 3) determinants of satisfaction, i.e., patient characteristics such as age, gender, education, diagnosis self-reported health status and frequency of visits. Descriptive statistics were generated. The determinant analysis consisted of constructing an overall preference score that was additive. A mixed model multivariate linear regression with repeated measures was used to assess any significant differences between NPs and physicians.

Limitations. The relatively low response rate may have resulted in selection bias where respondents and non-respondents were not comparable and therefore levels of satisfaction were over- or underestimated.

Summary of Findings

There were no significant differences between responders and non-responders with regard to age, gender and diagnosis. For 7 of 8 aspects of primary care, most patients preferred a general practitioner over an NP. Only for information and advice with how to deal with a disease did patients prefer an NP over a physician (36.5% versus 30.2%). Patients were generally very satisfied with both NP and physician care, with slightly higher scores for NPs. Patients were significantly more satisfied with the nurse for aspects of care related to support for the patient and their family and to the time made available to patients. Variation in preference and satisfaction were mostly attributable to variation in individual patient characteristics.

Threats to Validity/Generalizability. Small sample size, low response rate. For those patient characteristics found to explain the variance in satisfaction, the researchers were not able to assess differences between responders and non-responders thus compromising the generalizability even within the study population.

Article

Brown S and Grimes D. (1995). "A Meta-Analysis of Nurse Practitioners and Nurse Midwives in Primary Care." *Nursing Research* 44(8): 32-39.

Study Aims. To determine through meta-analytic methods the impact of nurses as primary care practitioners compared to physicians on health outcomes and the health care system. Specifically, to understand and describe processes of care and clinical outcomes by both practitioner types and to determine the influence of practice setting and patient characteristics on the magnitude and direction of effect.

Type of Study. Systematic review with 33 outcomes analyzed.

Study Methods. A literature search of both published and unpublished studies. Databases such as Medline and Dissertation Abstracts were used. Unpublished studies were requested from 30 health care and professional organizations. Attempts were made to identify complete data and to avoid redundancy by reviewing multiple publications by the same authors. 900 documents were screened, of these, 210 containing data on NP or NM care. Studies included satisfied the following criteria: an intervention was provided by an NP/NM or NP/physician or NM/physician team; care provided in U.S. or Canada; control group used; process of care or clinical outcomes presented; experimental, quasi-experimental or post facto research design and data to calculate effect size and direction of effect. 38 of the 142 NP studies and 15 of 68 NM met all criteria. Studies were rejected primarily because no physician control was used or the outcomes were not relevant to the analysis.

Sample Size. 38 NP and 15 NM studies.

Data Collection/Analysis. Studies were coded for descriptive data, method, research quality, substantive features and outcome variables on code sheets. Research quality was evaluated by systematically applying five criteria: study design, assignment to provider, sample selection, blinding and experimental mortality. Outcomes were coded as process of care and clinical outcomes. A consultant in meta-analysis reviewed the coding instrument, codebook, and coding process, as well as the data analyses and interpretation. Results were reported in weighted, effect size estimates.

Limitations. Only 12 of the 38 NP and one of the 15 NM studies involved a research design that randomized patients to provider, suggesting an overall lack of methodological rigor in the studies evaluated. Processes of care generally were not linked to outcomes, a significant shortcoming in understanding how patient care setting and provider activities relate to clinical outcomes.

Summary of Findings

NPs ordered slightly more tests than did physicians. Improvements in diastolic blood pressure and blood sugar levels, symptom relief, and resolution of Otitis media were higher for NPs than physicians; NPs received higher patient satisfaction scores; quality of care was equivalent between NPs and physicians as was prescribing practices, number of patient visits and patients' emergency department use. The NM studies occurred in hospitals, hospital-based ambulatory care centers and birthing centers. Among low-risk patients, those attended by a NM received less analgesia, anesthesia and fetal monitoring and fewer episiotomies, forceps deliveries, amniotomies and intravenous fluids. Cesarean section rates were equivalent between NM and physicians; although NM patients experienced more spontaneous vaginal deliveries and more first degree perineal lacerations. NM and physician patients had equivalent rates of fetal distress and comparable 1-minute Apgar scores. NMs delivered fewer low-birth weight babies.

Threats to Validity/Generalizability. Much of the research lacked methodological rigor in study design and specification of processes of care as related to clinical outcomes.

Article

Oakley D, Murray M, Murtland T, Hayashi R, Andersen F, Mayes F, Rooks J. (1996). "Comparison of Outcomes of Maternity Care by Obstetricians and Certified Nurse midwives." *Outcomes of Care* 88(5): 823-29.

Study Aims. To determine whether pregnancy outcomes differ by provider group when alternative explanations are taken into account.

Type of Study. Observational study.

Study Methods. Prenatal and intrapartum care outcomes were compared from women receiving care from 22 obstetricians compared to 8 CNMs that were affiliated with a Midwestern tertiary-care center and its ambulatory care satellite and hospital clinics. The study site's history and philosophy precluded random assignment since consumer choice is honored. At intake, all women qualified for nurse-midwifery care, i.e., were at low-risk.

Sample Size. After informed consent, 1,464 women agreed to participate and complete an initial questionnaire, 891 in the obstetrician group and 573 in the nurse-wife group. Of this initial group, 1,181 remained in the study and delivered at the study hospital (710 in the OB group and 471 in the NM group).

Data Collection/Analysis. Participants completed four questionnaires throughout the time of the study: at the first visit, at 32 weeks of pregnancy, immediately postpartum, and at 6 weeks postpartum.

Satisfaction of care was collected through a questionnaire completed immediately postpartum. Process of care and outcomes were extracted from medical charts. Chart and billing data were collected from onset of pregnancy to 2 months after birth. Newborn data included the first 2 weeks post birth, thereafter infants were seen by a pediatrician. A maternity nurse-researcher trained the extractors of survey data to be 100 percent accurate in recording data from patient charts.

Limitations. One setting; not randomized; potential self-reporting bias from patient surveys and selection bias.

Summary of Findings

Study participants did not differ in marital status, education, occupation, parity, cesarean or abortion history, or psychosocial characteristics from those who did not complete the study. However, women not enrolled had higher incidences of previous miscarriage (24% vs. 18%). Both NM and physician study groups had comparable demographic profiles. Significant differences in process of care and outcomes between obstetricians and Nurse midwives included: infant abrasions (6.9% OBs vs. 3.6% NM), infant staying with mother during hospital stay (14.2% OBs vs. 26.3% NMs), major perineal laceration (23.3% OBs vs. 6.6% NMs), post-partum hemorrhage (25.2% OBs vs. 14.2% NMs) average number of complications (.67 OBs vs. .37 NMs), satisfaction on 5-point scale was significantly higher for NMs than OBs (4.36 vs. 4.23). Average hospital charges and professional fees for the mother's care were significantly lower for women in the NM group as opposed to the OB group. Infant outcomes were excellent for women in both groups.

Threats to Validity/Generalizability. Self-selection bias into the midwife group and lack of random assignment. Intent-to-treat considerations were included in the study design thus strengthening the overall validity of the findings where those who developed complications in the NM group and required an obstetric consultation continued to be analyzed as part of the NM group.

Article

Simonson D, Ahern M, and Hendryx M. (2007). "Anesthesia Staffing and Anesthetic Complications during Cesarean Delivery: A Retrospective Analysis." *Nursing Research* 56(1): 9-17

Study Aims. To identify differences in the rates of anesthetic complications in hospitals whose obstetrical anesthesia is provided solely by CRNAs compared to hospitals with only anesthesiologists. The difference between two types of hospitals was studied, not two types of anesthesia providers.

Type of Study. Observational. Secondary analysis of hospital discharge data and hospital survey data.

Study Methods. Washington State hospital discharge data was obtained from 1993-2004 for all cesarean sections and merged with a survey of hospital obstetrical anesthesia staffing. The survey was conducted initially in 1999 and included retrospective descriptions of staffing during 1993-98. The survey was updated in 2002 and 2004 and completed by anesthesia providers or medical staff administrators at the hospitals and included information on hospital characteristics and patient demographics.

Sample Size. In 2004, 68 of the 94 hospitals in WA provided obstetrical anesthesia services (44 urban and 24 rural). 28 used anesthesiologist-only staffing and 27 used CRNA-only staffing. Anesthesiologist-only staffing represented 59 percent of urban hospitals and CRNA-only staffing represented 79 percent of rural hospitals. The study involved 134,806 patients, 33,236 received anesthesia care from CRNAs only and 101,570 from anesthesiologists only.

Data Collection/Analysis. The type of obstetrical anesthesia staffing and the operating room staffing for each hospital for each year was identified by the survey. Anesthetic complications were identified via International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes. Complications were noted by ICD-9-CM codes 668.0-668.9. Rates were risk-adjusted using regression analysis. Hospital administrative data were used to identify patients undergoing a cesarean section and the Washington State Department of Health provided data on hospital bed size and location (rural vs. urban). Hierarchical modeling was used to test individual and community effects on the dependent variable, i.e., incidence of complications.

Limitations. The study relied on administrative data that may not fully reflect complications that are recorded in medical charts. The accuracy of the survey could be limited by record keeping or by respondent memory of staffing patterns over the 12-year period.

Summary of Findings

CRNAs treated the greatest number of rural, teaching, urgent admission and very young (under 17) patients while anesthesiologists had the greatest percent of emergency admissions and older mothers (>35). CRNA-only hospitals were either smaller (<100 beds) or large tertiary-care size hospitals (>200 beds). Anesthesiologist-only hospitals were typically mid-sized community hospitals (100-200 beds). CRNA-only hospitals saw a greater percentage of Medicaid patients (43% vs. 30%). Analysis did not examine whether either type of hospital treated more patients with comorbid conditions. Significant differences were found in complication rates with CRNA-only staff having a complication rate of .58 percent whereas anesthesiologist-only staff had a rate of .76 percent. After adjusting for comorbidities, hospital size, teaching status, patient transfers, and other confounding variables, no difference was found in anesthetic complication rates or mortality rates.

Threats to Validity/Generalizability. Use of administrative data only as opposed to chart reviews. The study may be limited in its generalizability due to the specific location (WA) as other states and sections of the country have differences in statute and staffing patterns.

Article

Pine M, Holt K and Lou Y. (2003). "Surgical Mortality and Type of Anesthesia Provider." *AANA Journal* 71(2): 109-116.

Study Aims. To study the effect of type of anesthesia provider on surgical mortality associated with selected surgical procedures performed on Medicare beneficiaries.

Type of Study. Observational, analysis of secondary data.

Study Methods. Part A and Part B Medicare data were analyzed for patients hospitalized in 1995, 1996, or 1997 in 1 of 22 states if patients received one of 8 of specified operations. Further, patients had to reside in the state where the operation was performed; had undergone the procedure within days of admission and had a principle diagnosis that could be appropriately treated by the procedure. States were selected to yield a reasonable representation of CRNAs practicing in urban and rural facilities across the U.S. Type of provider, i.e., anesthesiologist-alone, a CRNA-alone or a team of anesthesiologist and CRNA was obtained from Part B billing data.

Sample Size. 586,422 cases met the initial criteria and 404,194 were included in the analysis.

Data Collection/Analysis. Cases were eliminated from the risk-adjusted models if they lacked Part B data, had invalid provider codes, were coded as emergencies or came from any hospital that performed

fewer than 15 similar operations on Medicare beneficiaries during the 3-year study period. The 1997 American Hospital Association (AHA) Annual Survey Database was used for describing hospital characteristics, location was determined by state and rural-urban codes contained in the AHA database. The degree of technology sophistication was ranked high, moderate, low or absent. A model computing the probability of dying was developed for each patient included in the study. A final risk-adjusted stepwise logistic regression model was specified that included institutional and geographic variables.

Limitations. Part B data reflect only services that were billed. Medicare data do not distinguish between risk factors and inpatient complications. Medicare data may fall short of capturing the preoperative risk of death. Also, the Medicare database does not permit precise identification of the cause of death.

Summary of Findings

Anesthesiologists-alone provided services in 33.2 percent of cases; CRNAs-alone in 8.2 percent and by anesthesia care teams in 58.6 percent of cases reviewed. There were no significant differences in risk-adjusted mortality rates by type of anesthesia provider or by type of anesthesia practice within the hospital. These findings did not change when risk-adjusted models omitted institutional and geographic variables.

Threats to Validity/Generalizability. Generalizability is limited to Medicare beneficiaries undergoing specific procedures. To enhance validity, the analysis used New York's SPARCS database, which clearly distinguished between comorbid conditions and complications.

Article

Silber, J., Kennedy S., Even-Shoshan O., Chen W., Koziol L., Showan A. and D. Longnecker. (2000). "Anesthesiologist Direction and Patient Outcomes." *Anesthesiology* 93(1): 152-163.

Study Aims. To compare the outcomes of surgical patients whose anesthesia care was performed or medically directed by an anesthesiologist with the outcomes of patients whose anesthesia care was not personally performed or directed by an anesthesiologist.

Type of Study. Observational, cross sectional analysis of Medicare claims records in Pennsylvania.

Study Methods. Medicare claims records for patients 65 yr or older were analyzed for general and orthopedic surgical admissions between 1991 and 1994. Cases billed to Medicare as personally performed or directed by an anesthesiologist were defined as "directed." Cases were labeled as "undirected" if on any day of the hospital stay anesthesia procedures performed were not directed by an anesthesiologist. Outcomes studied were death rate within 30 days of admission, in-hospital complication rates and the rate of failure-to-rescue cases. Outcomes were adjusted to account for severity of disease and other provider characteristics.

Sample Size. 245 hospitals were involved with 194,430 "directed" and 23,010 "undirected" cases.

Data Collection/Analysis. Data were collected from Medicare Standard Analytic Files and supplemented by the American Hospital Association's Annual Surveys for 1991-1993 and the Pennsylvania Health Care Cost Containment Council database for 1991-1994. Death within 30 days of admission was determined from the HCFA Vital Status file. Complications were identified using a set of 41 events defined by International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) and CPT (Physician's Current Procedural Terminology, 4th edition) codes.

Limitations. The assumption was made that all no-bill cases (n=14,137) were undirected, likewise billing codes for physician specialty coded as “unknown.” Medicare claims data are limited in the recording of complication rates which are often not accurately coded specifically for intra-operative events and specific perioperative complications.

Summary of Findings

Undirected patients were more likely to be male, have histories of arrhythmia, congestive heart failure and non-insulin-dependent diabetes and to be admitted through the emergency department. Undirected patients were less likely to have cancer. After adjustments for severity of illness and other confounding variables, higher mortality and failure-to-rescue rates were found for patients who underwent an anesthesia-related procedure without medical direction by an anesthesiologist. The odds ratio for death was 1.08 and failure to rescue 1.10. There were no differences found in complication rates.

Threats to Validity/Generalizability. Threats to validity include the limitations of Medicare data to accurately reflect complications and the lack of precision in defining “directed” and “undirected” care. Further, since the study only reviewed Medicare claims in Pennsylvania, practice pattern differences between states could not be controlled for.

Study Characteristics and Ratings

| Study | Lenaway et al., 1998 |
|-----------------------------------|---|
| Methods | Population-based quasi-experimental design |
| Setting | 3 counties in Colorado |
| Participation/sample size | 692 live births in intervention group |
| | 726 live births in comparison county A |
| | 1,373 live births in comparison county B |
| Outcomes | Adequacy of prenatal care; antepartum complications and birth outcomes. |
| Limitations/Bias/Generalizability | Limitations of birth certificates in the reporting of antepartum complications and delivery procedures. |
| | Only two counties selected to serve as comparison counties compromises generalizability. |
| | No baseline data collected |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Mundinger et al., 2000 |
| Methods | Randomized control trial |
| Setting | Four community-based primary care clinics (17 physicians) and 1 primary care clinic (7 NPs) at an urban academic medical center in New York City. |
| Participation/sample size | 1,316 enrolled patients |
| | 806 patients assigned to a nurse practitioner practice |
| | 510 patients assigned to physician practices |
| Outcomes | Patient satisfaction (12-item questionnaire) after first appointment and 6-months after enrollment; self-reported health status (SF-36) and physiologic test (for patients identified with one of several chronic conditions) after 6 months; service utilization 6 months prior to enrollment and 6 and 12 months after first appointment. |
| Limitations/Bias/Generalizability | <ul style="list-style-type: none"> - Patient could not be blinded at first point of contact with provider because of the recruitment setting, i.e., ED or urgent care clinic. - Limited generalizability because of patient demographics (low-income, Spanish-speaking immigrants). |
| Recommended Rating | Good |

| | |
|-----------------------------------|--|
| Study | Ohman-Strickland et al., 2008 |
| Methods | Analysis of secondary data from a group randomized intervention study |
| Setting | 46 family medicine practices in New Jersey and Pennsylvania |
| Participation/sample size | 28 physician-only practices |
| | 9 practices with 1 or more PAs |
| | 9 practices with 1 or more NPs |
| Outcomes | Practice characteristics; quality of diabetes care; organizational attributes and market orientation |
| Limitations/Bias/Generalizability | Small sample sizes and missing data affected the researcher's ability to detect significant differences in the process of patient care or organizational characteristics of the participating clinics. |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Venning et al., 2000 |
| Methods | Randomized control trial |
| Setting | 20 general practices dispersed throughout England and Wales |
| Participation/sample size | 1292 total patients |
| | 651 general practitioner visits |
| | 641 nurse practitioner visits |
| Outcomes | Process and content of patient visit, patient satisfaction, health status, follow-up clinic visits and costs per visit |
| Limitations/Bias/Generalizability | Location specific; was not apparent whether concept of "intent-to-treat" was applied; non-respondent demographics not compared to respondents |
| Recommended Rating | Good/Fair |

| | |
|-----------------------------------|---|
| Study | Litaker et al., 2003 |
| Methods | Randomized control trial |
| Setting | Department of General Internal Medicine at the Cleveland Clinic Foundation, a 1000 bed tertiary care teaching hospital in Cleveland Ohio. |
| Participation/sample size | 157 patients with hypertension and diabetes |
| | 79 assigned to a NP/MD team |
| | 78 assigned to a physician-only practice. |
| Outcomes | Patient satisfaction, quality of life, process of care measures, patient education and clinical outcomes. |
| Limitations/Bias/Generalizability | Small sample size, setting specific and physicians were not blinded as to the random assignment of patients |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Roblin et al., 2004 |
| Methods | Observational study; analysis of secondary data |
| Setting | Twenty six capitated primary care practices within a fully capitated group model MCO in Georgia. |
| Participation/sample size | Nearly 2 million visits provided by 206 practitioners: MDs, PAs and NPs |
| | PAs/NPs attended 32.4% of all adult medicine visits |
| | PAs/NPs attended 18.5% of all pediatric visits |
| Outcomes | Likelihood of a primary care visit to a NP/PA, type of visit, and aggregated labor costs. |
| Limitations/Bias/Generalizability | A closed panel, fully capitated HMO represents a distinctly different practice model than most primary care practices and therefore the findings may not be transferrable to other practice settings. |
| Recommended Rating | Good |

| | |
|-----------------------------------|--|
| Study | Grumbach et al., 2003 |
| Methods | Cross-sectional analysis of administrative and survey data |
| Setting | California and Washington |
| Participation/sample size | 33,673 providers |
| Outcomes | Geographic outcomes: practice in rural area, practice in a vulnerable population area or HPSA. Patient population outcome: the proportion of Medicaid, uninsured and minority patients seen in the practice. |
| Limitations/Bias/Generalizability | Possible item-response bias; may not be generalizable due to different orientations in states' training programs; non-physician database was less complete than the physician database |
| Recommended Rating | Fair |

| | |
|-----------------------------------|--|
| Study | Horrocks et al., 2002 |
| Methods | Systematic review of randomized controlled trials and prospective observational studies. |
| Setting | All developed countries were considered for review; the review was conducted in the UK. |
| Participation/sample size | 11 RCTs and 23 prospective observational studies. |
| Outcomes | Patient satisfaction, health status, length of visit, number of tests, prescribing patterns, scheduling return visits, referrals to specialists and quality of care. |
| Limitations/Bias/Generalizability | Limited number of quality studies; heterogeneity between studies; ambiguous definition of "nurse practitioner" resulting in an inclusive definition. |
| Recommended Rating | Good |

| | |
|----------------------------|---|
| Study | Hamric et al., 1998 |
| Methods | Convenience sample of APNs examining outcomes associated with APN prescriptive authority; state demonstration project |
| Setting | Mostly rural primary care clinics |
| Participation/sample size | 33 APNs in 25 different sites; 683 patients' outcomes were analyzed |
| Outcomes examined | APN and patient characteristics; APN and patient assessment of outcomes; physician evaluation of APN prescribing patterns and patient satisfaction. |
| Limitations/Potential Bias | Convenience sample, small sample size, single location, potential selection bias and no comparison group |
| Recommended Rating | Fair |

| | |
|----------------------------|---|
| Study | Laurant et al., 2004 |
| Methods | Systematic review of randomized controlled, controlled before and after and interrupted time series studies involving substitution of doctors by nurses in primary care. Included studies from 1966-2002. |
| Setting | Conducted in the UK but involved evidence-based reviews of studies conducted in the U.S., Canada, GB and the Netherlands. |
| Participation/sample size | 25 articles relating to 16 studies. |
| Outcomes examined | Patient clinical outcomes, processes of care and resource utilization including cost. |
| Limitations/Potential Bias | Rigorously designed studies were limited; individual studies had observed limitations such as small sample sizes and inability to assess the equivalence (not only difference) between nurses and physicians. |
| Recommended Rating | Good |

| | |
|---------------------------|--|
| Study | Laurant et al., 2008 |
| Methods | Observational study using cross-sectional survey to assess patients' preferences for and satisfaction with care provided by NPs and general practitioners. |
| Setting | Primary care practices that recently employed nurse practitioners |
| Participation/sample size | 235 patients |
| Outcomes examined | Patient and provider characteristics, satisfaction with care and factors influencing preference for provider |
| Limitations/Possible Bias | Low response rate to questionnaire, potential selection bias including a possible overestimation of satisfaction with both physicians and nurses. |
| Recommended Rating | Fair |

| | |
|----------------------------|--|
| Study | Brown and Grimes, 1995 |
| Methods | Meta-analysis of the quality of care of NPs and NMs compared to physicians in primary care. |
| Setting | Literature review across settings |
| Participation/sample size | 38 NP articles and 15 NM studies |
| Outcomes examined | Patient risks and clinical outcomes, patient satisfaction and quality of care |
| Limitations/Potential Bias | Few rigorously designed and executed studies; process of care among providers not well described which prevented assessing the association between process and outcomes. |
| Recommended Rating | Good |

| | |
|---------------------------|--|
| Study | Oakley et al., 1996 |
| Methods | Observational study comparing outcomes of maternity care by obstetricians and CNMs. |
| Setting | Midwestern tertiary-care center and its ambulatory care satellite and hospital clinics. |
| Participation/sample size | 710 patients receiving OB care and 471 receiving CNM care. |
| Outcomes examined | Newborn outcomes; maternal complications; hospital charges and patient satisfaction. |
| Limitations/Possible Bias | One setting; not randomized; potential self-reporting bias from patient surveys and self-selection bias. |
| Recommended Rating | Fair |

| | |
|----------------------------|---|
| Study | Simonson 2007 |
| Methods | Analysis of survey and administrative data to evaluate the quality of anesthesia care provided in Washington hospitals over a 12-year period. |
| Setting | CRNA-only and anesthesiologist-only hospitals in WA. |
| Participation/sample size | 68 hospitals in WA, 44 urban and 24 rural. 28 used anesthesiologist-only staffing and 27 used CRNA-only staffing. A total of 134,806 patients included, with 33,236 receiving anesthesia care by CRNAs- only and 101,570 by anesthesiologists-only. |
| Outcomes examined | Anesthetic complications and mortality. |
| Limitations/Potential Bias | Reliance on administrative data; accuracy of the survey data; state-specific data. |
| Recommended Rating | Good |

| | |
|----------------------------|--|
| Study | Pine et al., 2003 |
| Methods | Analysis of secondary data examining surgical mortality and type of anesthesia provider for the period 1995-97. |
| Setting | 22 states' Part B Medicare claims |
| Participation/sample size | 404,194 cases were analyzed |
| Outcomes examined | Outcome by type of procedure; anesthesia provider by procedure; anesthesia provider by state, geographic area and risk-adjusted mortality rates. |
| Limitations/Potential Bias | Medicare claims data limitations |
| Recommended Rating | Poor |

| | |
|---------------------------|---|
| Study | Silber et al., 2000 |
| Methods | Observational, cross sectional analysis |
| Setting | Analysis of billing data from Pennsylvania hospitals |
| Participation/sample size | 245 hospitals; 194,430 "directed cases" and 23,010 "undirected cases" |

| | |
|----------------------------|--|
| Outcomes examined | Complications by anesthesia provider and death within 30 days of admission |
| Limitations/Potential Bias | Medicare claims data limitations |
| Recommended Rating | Poor |

PHYSICIAN ASSISTANT EVIDENCE-BASED REVIEW

Article

Anderson D. and M. Hampton. (1999). "Physician Assistants and Nurse Practitioners: Rural-Urban Settings and Reimbursement for Services." *The Journal of Rural Health* 15(2): 252-262.

Study Aims. To examine the role of payment sources in the utilization of physician assistants (PAs) and nurse practitioners (NPs) comparing between rural and urban settings, PAs, NPs and the role of payment source in the utilization of physicians.

Type of Study. Cross-sectional analysis of secondary data.

Study Methods. This study analyzed data from the 1994 National Hospital Ambulatory Medical Care Survey (NHAMCS) of 29,095 out-patient visits to test two hypotheses: 1) the presence of a PA or NP at a patient visit is influenced by payment source; and 2) the influence of an HMO or prepaid payment source is independent of whether the visit was in a rural or urban setting. The types of clinics used for primary care in this study were general medicine, pediatrics, and obstetrics. The types of hospital ownership were voluntary nonprofit, nonfederal government, and proprietary. Proprietary was omitted in the analysis as the reference group.

Sample Size. A national probability sample of 29,095 outpatient records was drawn from the 1994 National Hospital Ambulatory Medical Care Survey (NHAMCS).

Data Collection and Analysis. Researchers used a logistic regression model to test the hypotheses stated above. Each payment source was included as an independent variable, additionally, type of clinic hospital ownership and intensity and nature of visit were added to the model as independent variables. An odds ratio of the probability of a PA or NP present at a hospital outpatient visit was calculated using logistic regression. The analysis was performed on all visits, on urban visits only and on rural visits only, with PA or NP present at the visit as the dependant variable. The analysis was repeated using physicians as the dependent variable. Rural and urban comparisons of were performed to understand the impact of payment sources on the probability of the various providers being present at a hospital outpatient visit.

Limitations. The results are only applicable to hospital outpatient department visits. The ratio of physicians to NPs and PAs employed at the hospital location was not calculated which could result in estimation errors. Identification in the data of whether the site was a Rural Health Clinic was also missing, since federal reimbursement policies in these clinics requires the use of an NP or PA this missing variable could also confound the results. State was not included in the model and it is well known that PA and NP prescriptive authority differs from state to state, another limitation in the model and interpreting the results.

Summary of Findings

PAs and NPs were present at 37 percent of rural visits compared to only 5 percent of urban visits. HMO and prepaid payments were more than five times more frequent at an urban visit than a rural visit; and private insurance and Medicare were both more than twice as likely to be the reimbursement

source in a rural setting. Out of pocket payments and Medicaid were twice as frequent for an urban visit as a rural visit. All payment types, except through an HMO, increase the probability of utilizing a physician assistant or nurse practitioner while HMO reimbursement increased the probability of using a staff physician. Medicaid and “other” sources of government reimbursement increased the probability of PA or NP reimbursement in a rural setting. In sum, practicing in a rural setting had a significant and positive impact on the likelihood of a NP or PA being utilized in a primary care visit in a hospital outpatient clinic. Medicaid was also found to be a significant predictor of NP and PA utilization. “Other government” including local, state and federal subsidies was also significantly predictive of a NP or PA being present at a visit. The authors concluded that this strong association suggests that government subsidies are supporting the use of NPs and PAs in nonfederal outpatient clinics in rural areas.

Threats to Validity/Generalizability. An observational study, with several missing variables in the model, suggests that the study should be classified as exploratory and confirmatory in its results. Since the sample represented a small subset of the total outpatient visits in U.S. hospitals, the results should be interpreted with caution.

Article

Wilson I., Landon B., Hirshhorn L., McInnes K., Ding L., Marsden P. and P. Cleary. (2005). “Quality of HIV Care Provided by Nurse Practitioners, Physician Assistants, and Physicians.” *American College of Physicians* 143 (10): 731-736

Study Aims. To compare the quality of care provided by NPs and PAs with that provided by physicians.

Type of Study. Cross-sectional analysis of primary data collected in a controlled evaluation study.

Study Methods. The study took place between June, 30, 2000 and September, 31, 2001. As part of a controlled evaluation of quality improvement collaborative, HIV care sites that received funds from the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act Title III were selected to participate. Study facilitators identified all clinicians with a primary responsibility for caring for patients with HIV. For sites with 5 or fewer clinicians, all clinicians were eligible for the survey. Among sites with more than 5 clinicians, 5 were randomly selected. Selected clinicians were asked about experience with quality improvement initiatives, physician background, and training. Response rates did not differ according to region, type, of clinic or survey wave. Each clinic selected 1 or 2 reviewers who were trained to use a chart abstraction tool. Chart reviewers were blinded to the study hypothesis.

Sample Size. Of the 62 potential sites, 42 (71%) provided chart review data to be included in the collaborative. Of the 40 sites that were eligible to be a control, 25 (63%) agreed to provide medical records for chart review. 75 patients were randomly sampled who had 1 visit or more during the review period from each site before and after the intervention. Overall, 243 clinicians were (177 physicians and 66 NPs (51) and PAs (15)) surveyed and the medical records of 6,651 patients with HIV or AIDS were reviewed.

Data Collection and Analysis. The sample of patients was limited to those clinicians who returned a survey. Patients who were not linked to a clinician were slightly more likely to be women (34% vs. 31%) and have lower CD4 cell counts (34% vs. 30%). Medical reviewers, who were typically clinic nurses, were asked to identify the name and title of the clinicians “who makes most major decisions regarding this patient’s care.” Chart reviewers collected various patient demographics while specifying whether each visit was with a physician, an NP or PA, a nurse, or “other” clinician. There were two review periods including the year before the intervention to gather baseline data and the year beginning 6-months after the start of the intervention and ending 3-months after the conclusion of the intervention.

Limitations. Selection bias where patients cared for by physicians may have had more complications than patients cared for by NPs/PAs. Health status was not measured nor was patient satisfaction.

Summary of Findings

PAs and NPs were the primary HIV clinicians for 20 percent of the study patients. NPs/PAs tended to see fewer patients per week than physicians (36 vs. 49), reported being the primary provider for fewer patients with HIV (107 vs. 164), and reported caseloads with higher numbers of patients with HIV (85% vs. 61%). Patients that were seen by an NP/PA were more likely to be younger, female, had fewer non-HIV-related comorbid conditions and were more likely to have active substance abuse documented in their medical record. Patients with an NP or PA as a primary HIV care provider had an average of 7.4 visits per year and 6.6 with those with a physician as their primary care provider. 46% of NP/PA patients visited a physician at some time during the study period and 16.2% of physician patients saw an NP/PA. After adjusting for patient characteristics, the performance of NPs/PAs was similar to that of physicians trained in infectious disease and general medicine HIV experts for 6 of the 8 quality measures and was superior to that of HIV expert physicians for the remaining 2 measures. NPs/ PAs performed better than generalist non-HIV experts on 6 of the 8 measures.

Threats to Validity/Generalizability. The results may not be generalizable to other care settings where on-site physician HIV experts are not accessible as this was the unit of comparison in the study.

Article

Enns S., Muma R. and M. Lary. (2000). "Examining Referral Practices of Primary Care Physician Assistants." *JAAPA* 13(5):81-87.

Study Aims. To assess referral practices and perceived barriers to referrals among primary care PAs practicing in the U.S.

Type of Study. Point in time, cross-sectional random sample survey.

Study Methods. Survey was administered by the Department of Physician Assistants at Wichita State University, Wichita, KA between September and October 1997. Primary care PAs were randomly selected from the 1997 database of the American Association of Physician Assistants (AAPA). The survey included questions on general demographics, practice setting and specialty, referral patterns and number of referrals per week and perceived barriers to successful referrals. PAs were asked to rate their satisfaction with their level of autonomy in making referrals and their satisfaction with reports received from specialists.

Sample Size. 500 primary care PAs were selected to participate, 256 (51%) returned the survey. 245 PAs were in active primary care practice and completed the survey.

Data Collection and Analysis. The 31-item survey was analyzed using standard descriptive statistics and univariate analysis of variables using Pearson chi-squared tests.

Limitations. Small sample size and self-response bias. Quality of care and cost-effectiveness were not addressed in the study. There was no discussion of whether the sample of respondents was similar to non-respondents.

Summary of Findings

79 percent of PAs responding referred 1-10 patients per week to their supervising physician and 75 percent referred 1-10 patients to an outside consulting physician per week. 71 percent of respondents

identified one or more barriers that affected successful referrals with the *predetermined consultation policy of the patient's health care insurer* being the most frequently cited reason (38%). Other barriers included: *refusal or reluctance of a specialist to accept a referral from a PA* (17%) and the *predetermined consultation policy of the PAs employer* (17%). 86 percent of PAs were satisfied with their level of practice autonomy.

Threats to Validity/Generalizability. The generalizability of this study is limited by its small sample size and scarce demographic information. The self response bias poses a threat to the validity of the results.

Article

Rudy E., Davidson L., Daly B., Clochesy J., Sereika S., Baldisseri M., Hravnak M., Ross T. and C. Ryan. (1998). "Care Activities and Outcomes of Patients Cared for by Acute Care Nurse Practitioners, Physician Assistants, and Resident Physicians: A Comparison." *American Journal of Critical Care* 7(4): 267-281.

Study Aims. To compare the care performed by acute care nurse practitioners (ACNPS) and physician assistants (PAs) and outcomes of their patients to the care activities and patient outcomes of resident physicians.

Type of Study. Cross sectional, observational study using retrospective chart reviews.

Study Methods. Two academic tertiary medical centers participated in the study, one in Pittsburg, PA and one in Cleveland, OH. The study sample had two populations: 1) ACNPS, PAs and a resident physician; and 2) ACNPS, PAs and a resident. 16 ACNPs and PAs and a matched group of resident physicians and residents were studied during a 14-month period. Data on the subjects' daily activities and patient outcomes were collected at 4 points in time for the study.

Sample Size. Of the 16 total ACNPs and PAs initially participating, 11 participated in all 4 data collection periods. A total of 54 one week daily log diaries were completed (270 days). One of the 54 residents in the study lost the diary, leaving a total of 53 diaries. 254 (94%) days were completed. 187 records were reviewed from the ACNP-PA group and 202 for the physician group.

Data Collection and Analysis. Daily log diaries were used to compare activities and tasks performed by ACNPs, PAs and physicians. Data were collected for one week every 3 months. Data collectors at each site reviewed log diaries with each participant to address questions and to instruct the participants on how to record the data. Residents rotated services monthly, making it impossible to match the ACNP or PA with the same physician every 3 months. Data collectors also reviewed patients' charts using an inter-rater reliability score for 10 percent of all charts which showed a high level of agreement (95%-97%). Scores in the Acute Physiology and Chronic Health Evaluation (APACHE) III and the Therapeutic Intervention Scoring System were used to describe the acuity of the patients.

Limitations. Patient outcomes measured in this study occurred rarely, suggesting that they may not have been good measures and that more sensitive measures should have been used. Complications, as defined by this study, were also rarely recorded in patient charts indicating that the ACNPs or PAs perception of a complication may have differed from those specified in the study design. Cost considerations limited the study's ability to directly observe the clinicians as they worked.

Summary of Findings

Resident physicians cared for patients who were older and sicker, cared for more patients, worked more hours and took a more active role in patient rounds by taking more time to write orders, consult, do procedures, review lab results and speak with patients. The researchers speculated that this may

have been the result of a more complicated patient mix although patients in both groups had the same length of stay at the hospital. The NPs and PAs were more likely to discuss patients with bedside nurses and to interact with patients' families. They spent more time in research and administrative activities. NPs and PAs were also more likely to include patient's social history in the admission notes. Outcomes did not differ significantly for patients treated by either group.

Threats to Validity/Generalizability. There were several differences between provider groups, location, and patient demographics that limit the generalizability of this study. The results are limited by the nature of the work setting, i.e., an academic medical center and the reliance on self-reported diaries.

Article

Cipher D. and R. Hooker. (2006). "Prescribing Trends by Nurse Practitioners and Physician Assistants in the United States." *Journal of the American Academy of Nurse Practitioners* 18: 291-296.

Study Aims. To study the characteristics of providers and patients, and the type of prescriptions written by NPs and PAs in primary care and to compare these activities to physicians.

Type of Study. Secondary analysis of the National Ambulatory Medical Care Survey (NAMCS) from 1997-2002.

Study Methods. This study used NAMCS data, an annual, multistage, probability sample survey of 2500 office-based physicians conducted by the National Center for Health Statistics (NCHS). The survey includes PAs and NPs along with physicians in its evaluation of ambulatory care visits.

Sample Size. A total of 149,202 visits which included all 6 years for all specialties. Among the four primary care specialties, the total number of visits was 88,346.

Data Collection and Analysis. The survey asked physicians to complete an encounter form for a sample of approximately 30 patient visits in a randomly assigned one-week reporting period. If NPs or PAs were the provider of record for the visit, they were listed on the encounter form. The survey collected patient demographics, diagnosis, services provided and medications prescribed.

Limitations. NAMCS data is reported by physicians only and may contain reporting biases. The NAMCS visit record did not distinguish between new and continuing medications. Assessing the outcome of a visit where a medication was prescribed was impossible since the data collected from NP and PA visits were too small.

Summary of Findings

A significantly larger proportion of NPs were found to be practicing in primary care when compared to PAs and physicians (59.9% of NPs vs. 33.1% of PAs and 40.5% of physicians). There were not significant differences across providers for the number of medications prescribed, including controlled substances. Significant differences in prescribing patterns emerged when metropolitan status was considered. Rural PAs prescribed fewer medications than urban PAs and fewer medications than rural NPs and physicians. Rural NPs prescribed significantly more medications than rural PAs and physicians. It was found that the mean number of medications recorded per visit was similar across providers.

Threats to Validity/Generalizability. Although this study uses national survey data, it does not account for various scopes of practice in each state that may regulate NPs and PAs authority to prescribe, which could affect how the data is analyzed.

Article

Hooker R., Potts R. W. and Ray. (1997). "Patient Satisfaction: Comparing Physician Assistants, Nurse Practitioners, and Physicians." *The Permanente Journal* 1(1): 38-42.

Study Aims. To explore differences in patient satisfaction with physician and non-physician providers. A second objective was to examine concurrently the attitudes of patients of three types of providers to see if previous observations could be supported by a large-scale study.

Type of Study. Secondary analysis of an ongoing Art of Medicine Survey developed by Kaiser Permanente and used by 10 of 12 Kaiser Regions around the country.

Study Methods. The study was conducted through the Northwest Division of Kaiser Permanente (KP-NW), which is a prepaid, group-practice HMO. KP-NW maintains one hospital and 20 ambulatory care medical offices. Questionnaires were randomly mailed to patients whose appointments were entered on the daily schedule between 1995 and the first part of 1996. The 8-item questionnaire had been validated and found to have strong statistical correlation with overall satisfaction.

Sample Size. Approximately 300 surveys during a one-year period were analyzed out of over 30,000 returned surveys over a 5-year period.

Data Collection and Analysis. Results were based on "about" 100 completed questionnaires for each provider type. The eight-tem questionnaire used response scale of 1 to 9. In making comparisons, a difference of 3 percentage points was considered significant. Patient scores were combined to generate a mean score for each attribute by provider type.

Limitations. The analysis described in this Article lacked sufficient details to state sample size, patient characteristics, and reason for patient visit or the larger sample from which the data for this analysis was drawn, therefore response rate was also unknown.

Summary of Findings

Statistically different scores were not found between physicians and non-physician providers.

Threats to Validity/Generalizability. The generalizability of this Article is limited due to its HMO setting. The study design was so inadequately discussed that one would be wise not to over interpret the results.

Article

Roblin D, Howard D, Becker E, Adams E and Roberts M. (2004). "Use of Midlevel Practitioners to Achieve Labor Cost Savings in the Primary Care Practice of an MCO." *Health Care Economics* 39 (3): 607-625.

Study Aims. To estimate the savings in labor costs per primary care visit that might be realized from an increased use of physician assistants (PAs) and nurse practitioners (NPs) in the primary care practices of a managed care organization (MCO).

Type of Study. Observational analysis of computerized visit records and payroll ledgers over a three-year period.

Study Methods. The likelihood of a visit attended by an NP or PA was modeled using logistic regression, practice effects were fixed in the model and included department (adult medicine or pediatrics). Models were estimated separately by year. The dependent variable was whether a NP/PA attended the visit. The study included visit and payroll data from 26 capitated primary care practices of a group model HMO. Data on approximately 2 million visits provided by 206 practitioners for 1997-2000 were extracted for the analysis.

Sample Size. Two million patient records for 1997-2000 representing approximately 275,000 members.

Data Collection. Computerized patient visits (completed at the time of visit containing patient history, attending practitioners and ICD-9-CM codes); computerized enrollment forms containing patient demographics and computerized timesheets and payroll ledgers were used to analyze labor costs. Analysis was performed on the association between extent of use of PAs and NPs in primary care delivery and visit labor costs adjusting for patient case mix. A three-step model was used. The principal hypothesis was that average annual labor costs per visit would significantly vary with the propensity of a practice to use PAs and NPs.

Limitations. Limited generalizability due to the practice model, a fully capitated HMO. Estimates of costs savings used a linear model which may not be a realistic assumption.

Summary of Findings

PA/NPs attended 32.4% adult medicine visits and 18.5% pediatric visits. Younger patients were much more likely than older patients to have an PA/NP visit; variations in the use of NPs/PAs in care delivery was a consequence of their level of employment in a practice, a higher proportion of PAs/NPs was positively correlated with visit as a percent of practice visits. Labor costs per primary visit averaged \$24 for practitioner labor and \$36 for total labor per practice year in adult medicine; labor costs in pediatrics were higher. When adjusting for patient case mix, practices that used NPs/PAs more extensively had significantly lower average practitioner labor costs. In this HMO, PAs/NPs were compensated at approximately 50 percent of an internist physician.

Threats to Validity/Generalizability. Findings from this analysis cannot be generalized to most primary care practices as the practice model is that of a closed panel HMO that is fully capitated and therefore has the ability to organize primary care in a more deliberate and cost-effective manner.

Article

Ohman-Strickland, P. et al. (2008). "Quality of Diabetes Care in Family Medicine Practices: Influence of NPs and PAs." *Annals of Family Medicine* 6(1):14-22.

Study Aims. To assess whether the quality of diabetes care differs among practices employing NPs, PAs, or neither and whether practice attributes contribute to differences in process or outcomes of care. This study examined the dynamics of team versus non-team based practices.

Type of Study. Cross-sectional analysis of baseline secondary data from a quality improvement trial in 46 non-residency family medicine practices participating in ULTRA (Using Learning Teams for Reflective Adaptation), a group randomized intervention study.

Study Methods. Cross-sectional study of 46 family medicine practices from New Jersey and Pennsylvania. 28 practices did not employ an NP or PA, 9 practices employed one or more PAs and 9 practices employed one or more NPs. Basic information about office practice was collected from the office manager or physician using a standardized form. 846 patient charts audits were conducted by nurse

auditors to assess adherence to American Diabetes Association diabetes guidelines. Logistic regression analysis determined differences between practices with and without NPs and PAs.

Sample Size. 46 family medicine practices: 28 had neither a PA nor an NP on staff, 9 practices had 1 or more PAs and 9 practices had 1 or more NPs. Two practices that had both PAs and NPs were excluded.

Data Collection. Baseline data were collected from 46 nonresidency family medicine practices participating in ULTRA (Using Teams for Reflective Adaptation), a group randomized intervention study. Audits from medical records assessed adherence to guidelines for diabetes care using the clinical practice guidelines of the American Diabetes Association (ADA). Practice managers or lead physician completed a questionnaire to categorize practice characteristics. Staff members then completed a 20-minute self-administered questionnaire that assessed the practice's staff participation in decision-making.

Limitations. Relatively small number of practices that employed NPs and PAs. Small sample sizes and missing data affected the researcher's ability to detect significant differences in the process of patient care or organizational characteristics. Patient socioeconomic and demographic characteristics were not collected and they could have been confounding influences to explain findings. The study may not be generalizable to other small family medicine practices because findings focused on average trends across practices rather than highlighting unique characteristics of individual practices.

Summary of Findings

The three practice types were compared. Comparison of practices w/ NPs vs. practices w/ PAs found that NPs were almost twice as likely to assess HbA_{1c} levels, were more likely to assess lipid levels (80% vs. 58%) and were 5 times more likely to assess microalbumin levels than PAs. NPs were 37% more likely to meet treatment guidelines for lipids and were 45% more likely to have patients attain lipid targets. Comparison of practices w/ NPs vs. practices with physicians only found NPs were more likely to assess HbA_{1c} levels (66% vs. 49%) and also more likely to assess lipid levels than physicians (80% vs. 68%), these differences were both statistically significant. The final comparison was between practices w/ PAs vs. physicians only. PAs were 67% less likely to assess microalbumin levels, PAs were also less likely to assess HbA_{1c} and lipid levels but the differences were not statistically significant. The authors concluded that practices employing NPs significantly outperformed all other practice types studied.

Threats to Validity/Generalizability. The study assessed the overall effects of team-based practices in the treatment of patients with a chronic health condition.

Article

Grumbach K, Hart L, Mertz E, Coffman J and L Palazzo. (2003). "Who is Caring for the Underserved? A Comparison of Primary Care Physicians and Nonphysician Clinicians in California and Washington." *Annals of Family Medicine* (2): 97-104.

Study Aims. To compare the geographic distribution and patient populations of physicians and non-physician primary care clinicians.

Type of Study. Observational, cross-sectional analysis of administrative and survey data.

Study Methods. This study was an analysis of administrative and survey data about primary care clinicians (family physicians, general internists, general pediatricians, nurse practitioners, physician assistants and certified nurse midwives) in California and Washington. Geographic and patient population outcomes were examined. Geographic outcomes were practice in a rural area, practice with a vulnerable

population or practice in a health professions shortage area (HPSA). Patient population outcomes included the proportion of Medicaid, uninsured and minority patients seen in the practice.

Sample Size. 33,673 clinicians included in the analysis.

Data Collection. 1998 administrative and survey data about primary care physicians in CA and WA were obtained from the American Medical Association Physician Master file. The analysis was restricted to physicians active in patient care, not in training and with a primary self-reported specialty of family medicine (including general practice), internal medicine, pediatrics and OB/GYN. Data for non-physician primary care providers were gathered from a 1998 mail survey (CNMs were not surveyed in WA). Clinicians' main practice addresses were geo-coded and participating providers were assigned to service areas. Underserved areas were classified as rural community, area was a vulnerable population community or the area was designated as a primary care health professions shortage area (HPSA).

Limitations. The non-clinician databases were less reliable than the AMA's Physician Master File. PAs and NPs may be more likely to value caring for vulnerable populations resulting in item response bias which overestimates Medicaid, number of uninsured patients and minority patients.

Summary of Findings

PAs ranked first and second for each state regarding percent working in rural areas and HPSAs. In CA, PAs also had the greatest proportion of their members working in vulnerable population areas. Compared to physicians, NPs and CNMs (CA only) tended to have a greater proportion working in rural areas and HPSAs. Family physicians were much more likely than other types of primary care physicians to work in a rural area or HPSA. Non-physician clinicians in CA had a substantially greater proportion of Medicaid, uninsured, and minority patients in their practices.

Threats to Validity/Generalizability. May not be generalizable due to differences in the orientation of PA and NP training programs across the states.

Study Characteristics and Ratings

| Study | Anderson et al., 1999 |
|-----------------------------------|--|
| Methods | Cross-sectional observational analysis of secondary data |
| Setting | Nationwide survey of primary care clinics and nonprofit, nonfederal government, hospitals |
| Participation/sample size | 29,095 randomly selected outpatient records |
| Outcomes | Impact of payment source on provider type |
| Limitations/Bias/Generalizability | Only hospital outpatient visits |
| | Missing PA to NP ratio and identification of Rural Health Clinics could confound study findings. |
| Recommended Rating | Fair |

| Study | Wilson et al., 2005 |
|-----------------------------------|--|
| Methods | Cross-sectional observational study |
| Setting | HIV care sites that received funds from the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act Title III |
| Participation/sample size | 42 intervention sites and 25 control sites |
| | 243 physicians, NPs, and PA were surveyed |
| | 6,651 medical records were reviewed |
| Outcomes | Practice patterns and quality of care |
| Limitations/Bias/Generalizability | Selection bias; health status was not measured nor was patient satisfaction |
| Recommended Rating | Good |

| | |
|-----------------------------------|--|
| Study | Enns et al., 2000 |
| Methods | Cross-sectional observational study |
| Setting | 1997 database of the AAPA |
| Participation/sample size | 500 PAs were included in sample with 256 (51%) returning the survey; 245 PAs were included in study results. |
| Outcomes | Weekly referrals to specialists and weekly referrals to supervising physicians |
| Limitations/Bias/Generalizability | Self response bias, no analysis of difference between respondents and non-responders |
| Recommended Rating | Fair |

| | |
|-----------------------------------|--|
| Study | Rudy et al., 1998 |
| Methods | Cross-sectional observational study |
| Setting | Two academic tertiary medical centers, one in Pittsburgh, PA and one in Cleveland, OH. |
| Participation/sample size | 11 ACNPs and PAs participated |
| | 54 one-week daily log diaries were completed by ACNPs and PAs |
| | 53 diaries were completed by resident physicians |
| | 187 records were reviewed from the ACNP/PA group and 202 from the resident group |
| Outcomes | Differences in care-related activities, personal activities and clinical outcomes |
| Limitations/Bias/Generalizability | Outcomes selected for analysis were questioned, definition of “complications” used by study was perceived differently by provider type, cost limitations prohibited the study’s ability to directly observe patient care |
| Recommended Rating | Fair |

| | |
|-----------------------------------|---|
| Study | Cipher et al., 2006 |
| Methods | Secondary analysis of a large national survey |
| Setting | NAMCS data analysis from 1997-2002 |
| Participation/sample size | Total number of visits was 149,202 for all specialties and 88,346 for the four primary care specialties studied. |
| Outcomes | Prescriptive behavior by provider type |
| Limitations/Bias/Generalizability | NAMCS data is reported by physicians only and may contain reporting bias, records did not distinguish between new and continuing medications and the NP/PA sample size was small. |
| Recommended Rating | Fair |

| | |
|-----------------------------------|--|
| Study | Hooker et al., 1997 |
| Methods | Secondary analysis of ongoing <i>Art of Medicine</i> Survey |
| Setting | Northwest Division of Kaiser Permanente (KPNW) |
| Participation/sample size | About 300 surveys |
| Outcomes | Patient satisfaction |
| Limitations/Bias/Generalizability | Did not report sample size, patient characteristics, reason for visit or any other identifying characteristics that could affect results, i.e., level of satisfaction with provider. |
| Recommended Rating | Poor |

| | |
|-----------------------------------|---|
| Study | Roblin et al., 2004 |
| Methods | Observational study; analysis of secondary data |
| Setting | Twenty six capitated primary care practices within a fully capitated group model MCO in Georgia. |
| Participation/sample size | Nearly 2 million visits provided by 206 practitioners: MDs, PAs and NPs |
| | PAs/NPs attended 32.4% of all adult medicine visits |
| | PAs/NPs attended 18.5% of all pediatric visits |
| Outcomes | Likelihood of a primary care visit to a NP/PA, type of visit and aggregated labor costs |
| Limitations/Bias/Generalizability | A closed panel, fully capitated HMO represents a distinctly different practice model than most primary care practices and therefore the findings may not be transferrable to other practice settings. |
| Recommended Rating | Good |

| | |
|-----------------------------------|--|
| Study | Ohman-Strickland et al., 2008 |
| Methods | Analysis of secondary data from a group randomized intervention study |
| Setting | 46 family medicine practices in New Jersey and Pennsylvania |
| Participation/sample size | 28 physician-only practices |
| | 9 practices with 1 or more PAs |
| | 9 practices with 1 or more NPs |
| Outcomes | Quality of diabetes care |
| Limitations/Bias/Generalizability | Small sample sizes and missing data affected the researcher's ability to detect significant differences in the process of patient care or organizational characteristics of the participating clinics. |
| Recommended Rating | Fair |

| | |
|-----------------------------------|--|
| Study | Grumbach et al., 2003 |
| Methods | Cross-sectional analysis of administrative and survey data |
| Setting | California and Washington |
| Participation/sample size | 33,673 providers |
| Outcomes | Propensity to practice in a rural area, with a vulnerable population area or in a HPSA. Proportion of Medicaid, uninsured and minority patients seen in a practice. |
| Limitations/Bias/Generalizability | Possible item-response bias; may not be generalizable due to different orientations in states' training programs; non-physician database was less complete than the physician database |
| Recommended Rating | Fair |

Appendix I Miscellaneous Tables

Table I.1. Summary of research concerning NP and Physician Collaboration

| Citation | Title | Purpose and Area Studied | Sample, Setting and Methods | Findings | Barrier Themes | Strategies to Improve Collaboration |
|----------------------------|---|--|--|--|---|--|
| Bailey et al ²¹ | Family physician/NP: Stories of collaboration | Qualitative account of experiences of NP and physicians in collaborative practice The impact of education on the inter-professional relationships between NPs and FPs; perspectives of FP and NP control over practice and roles in health promotion and disease prevention | 13 FPs, 5 NPs from 4 primary care practices in Canada Narrative interviews and analysis | <ul style="list-style-type: none"> ▪ FPs unclear about NP role ▪ FPs based NP practice on limited knowledge of NP scope of practice ▪ FPs felt less control over own practice ▪ More positive perspectives of collaboration within institutions that had formal orientation to collaboration ▪ NPs spend more time than FPs on disease prevention and health promotion ▪ Need definition and structure to collaborative practice | <p>Lack of knowledge on NP role</p> <p>Lack of knowledge about NP scope of practice</p> | Provide structured orientation of a collaborative practice to all involved providers |

²¹ Bailey P, Jones L, Way D. (2005). "Family Physician/Nurse Practitioner: Stories of Collaboration." *J Adv Nurs*. 53:381-391.

| Citation | Title | Purpose and Area Studied | Sample, Setting and Methods | Findings | Barrier Themes | Strategies to Improve Collaboration |
|-----------------------------|--|---|---|---|--|--|
| Cairo ²² | Emergency physicians' attitudes toward the emerging role of NPs: validation versus rejection | Examined emergency department physicians' attitudes about collaboration with NP Examined misconceptions about NPs scope of practice; examined how ED physicians conceptualized the NP role | 5 emergency physicians in an ED in a city hospital Interviews: Open-ended questions | <ul style="list-style-type: none"> ▪ Some physicians accepted NP role ▪ Some physicians reluctant to accept NP role ▪ Physicians thought collaboration was more independent ▪ NPs viewed their role as more independent | Lack of knowledge about NP role Poor physician attitudes with regard to NPs | Increased contact between NP and medical students while still in education And establishing collaborative practice agreements |
| Hallas et al. ²³ | Attitudes and beliefs about effective pediatric NP and physician collaboration | Explore PNP and physician attitudes and beliefs about collaboration in a primary care setting Identify common themes of collaboration | 24 PNP and pediatrician teams PNP (n=34) Pediatricians (n=24) Questionnaire: 8 open-ended questions using a Likert scale | <ul style="list-style-type: none"> ▪ Collaboration defined as working together, consulting, sharing common goals and complementary practice ▪ Critical components of a collaborative practice: trust, mutual respect, communication, shared practice, competence and similar vision ▪ Red flags to collaboration: lack of respect, territorial issues, poor attitude, incompetence, professional inflexibility, ineffective communication ▪ The word consultation versus independent or supervision should be used to describe NP-physician collaboration | Barriers: Lack of knowledge about NP role Lack of knowledge about NP scope of practice Poor physician attitudes about nurses Lack of respect | Incorporate collaborative practice opportunities in medical and nursing education programs |

²² Cairo M. (1996). "Emergency Physician's Attitudes toward the Emerging NP Role: Validation Versus Rejection." *J Am Acad Nurse Pract.* 8(9):411-417.

²³ Hallas DM, Butz A, Gitterman B. (2004). "Attitudes and Beliefs for Effective Pediatric NP and Physician Collaboration." *J Pediatr Health Care* 18(2):77-86.

| Citation | Title | Purpose and Area Studied | Sample, Setting and Methods | Findings | Barrier Themes | Strategies to Improve Collaboration |
|----------------------------|--|--|---|--|--|--|
| Mackay ²⁴ | General practitioners (GPs) perceptions about the NP role; an exploratory study | <p>Explore GPs perceptions of NP role</p> <p>Explore experiences of nurses in advanced practice</p> <p>Assessed role function and potential problems with NP role</p> | <p>108 GPs in New Zealand</p> <p>Questionnaire using a Likert scale</p> | <ul style="list-style-type: none"> ▪ NPs performance of patient education perceived as favorable ▪ GP uncertainty about NP prescribing role ▪ GP uncertainty about NP role ▪ Greatest problem is funding of NP services ▪ NPs are a cheap option of the government ▪ Confusion over role and professional boundaries ▪ GPs perceived competition with NPs ▪ Overall favorable acceptance of NPs, but ongoing concern about prescribing, physical examinations, ordering laboratory tests and funding | <p>Lack of knowledge about NP role</p> <p>Lack of knowledge about NP scope of practice</p> | <p>More GP education about NP role; more information about NP responsibilities</p> <p>GPs with positive experience as supervisors; NPs should share their experience with GPs that are incorporating NPs into their practice</p> |
| Martin et al ²⁵ | The collaborative healthcare team: Intensive issues warranting ongoing consideration | <p>Discusses ongoing issues that MDs and APNs face in interdisciplinary practice in a LTC setting; assessed perceptions of teamwork; explored common issues about collaborative practice</p> | <p>A single group practice in a skilled nursing facility (5 MDs and 8 APNs)</p> <p>Interviews: open-ended questions</p> | <ul style="list-style-type: none"> ▪ MDs acknowledge their commitment to teamwork but felt an ultimate responsibility for NP practice ▪ MDs not knowledgeable about NP education and training ▪ MDs and NPs disagree about time commitment and hours worked ▪ NPs open to learning from MDs but feeling was not reciprocated ▪ Absence of information-sharing | <p>Lack of knowledge about NP scope of practice</p> <p>Poor physician attitude about NPs</p> <p>Poor communication</p> | <p>Introduce informal and formal strategies for better communication among team members; Provide a general orientation for NPs and MDs about practice responsibilities; NPs and MDs should discuss their education, background, area of specialty and strengths; and schedule monthly meetings that discuss effective communication.</p> |

²⁴ Mackay B. (2003). "General Practitioners' Perceptions of the Nurse Practitioner Role: An Exploratory Study." *N Engl Med J*. 116:1-8.

| Citation | Title | Purpose and Area Studied | Sample, Setting and Methods | Findings | Barrier Themes | Strategies to Improve Collaboration |
|--------------------------|---|--|---|---|--|---|
| Shaw et al ²⁶ | Do primary care professionals work as a team: A qualitative study | Evaluate the personal medical services model in collaborative primary care practices | Primary care staff in an inner-city of London; 48 staff members from 21 different practices Interviews | <ul style="list-style-type: none"> ▪ Poor teamwork ▪ Lack of shared objectives ▪ Poor communication ▪ Hierarchal structures ▪ No common purpose ▪ No shared goals | Poor communication Poor physician attitudes Poor communication | Include team development support; involve all practitioners in improving communication; establish shared goals early in the collaborative process Avoid attitudes that may reinforce a hierarchal practice structure |

Legend: Nurse practitioner (NP); Pediatric NP (PNP), Family physician (FP); General practitioner (GP); Adult care NP (ACNP); Emergency department (ED); Medical doctor (MD); Advanced practice nurse (APN).

²⁵ Martin D, O'Brien J, Heyworth J, Meyer N. (2005). "The Collaborative Health Care Team: Extensive Issues Warranting Ongoing Consideration." *J Am Acad Nurse Pract* 17(8):325-330.

²⁶ Shaw A, de Lusignan S, Rowlands G. (2005). "Do Primary Care Professionals Work as a Team: A Qualitative Study." *J Interprof Care* 19(4):396-405.

Table I.2. Comparison of Existing and Proposed Oral Health Professionals

| | Community Dental Health Coordinator | Advanced Dental Hygiene Practitioner | Dental Therapist |
|-------------------------|--|---|---|
| Developed by | American Dental Association | American Dental Hygienists' Association | Dental therapist model developed in New Zealand, in use in 40 countries. The Indian Health Service, Alaska Tribal Health Consortium, employs dental health aide therapists. |
| Stage of development | Planning stage Curriculum developed and approved 8/08 | Planning stage; curriculum being developed | Eight trained and practicing in Indian Health Service sites in Alaska |
| CODA standards | Being developed | Not planned | Not planned |
| Education/training | 18 months | Two-year master's program | Two-year program at dental school in New Zealand; education begins in Alaska in 2007 |
| Certification/licensure | Certification | Licensure | Certified by Indian Health Service board |
| Proposed settings | Community-based and public health roles; private offices | Hospitals, nursing homes, clinics, public health settings, or private offices | Indian Health Service clinics |
| Proposed supervision | Dual: education under general supervision; patient care under direct or indirect supervision | Unsupervised or general supervision; in collaborative practice with dentist, physician, or clinic manager | General supervision; operators under standing orders; dentists review x-rays and treatment plans electronically |
| Preventive capacity | Prevention education; fluorides; sealants | Comprehensive prevention services | Fluoride treatments; sealants |
| Treatment capacity | Gingival scaling; coronal polishing | Manage care for referred periodontal patients; prophylaxis | X-rays; gingival scaling; prophylaxis |
| Restorative capacity | None | Restorations; simple extractions | Restorations; stainless steel crowns; extractions |

Table I.3. Scope of Dental Hygienist Practice: 7-State Comparison

| | AZ | CO | NM | OR | WA | WI | WY |
|------------------------|----|----|-----|-----|-----|-----|----|
| Prophylaxis | N | U | N/U | N/U | N/U | N/U | N |
| X-rays | N | N | N/U | N/U | N | N | N |
| Local anesthesia | P | P | P | N | P | P | P |
| Topical anesthesia | N | U | N | N/U | N | N | N |
| Fluoride | N | U | N/U | N/U | N/U | N | N |
| PIT/Fissure Sealants | N | U | N | N/U | N/U | N | P |
| Root Planting | N | N | N | N/U | N/U | N | N |
| Soft Tissue Curettage | N | U | N | N/U | P/U | | |
| Administer N2O | P | P | | P | P | | P |
| Study cast impressions | N | N | N | N/U | N | N | N |
| Place perio dressings | P | N | | N/U | P | N | P |
| Remove perio dressings | P | N | N | N/U | P | N | P |

Key:

P = physical presence of dentist is required

N = physical presence of dentist is not required

U = neither physical presence of dentist nor authorization by dentist required but there may be a requirement for some type of collaborative arrangement with a dentist, or some type of experience/special requirement by RDH.

/ = Where two letters are present in a box, the first indicates the supervision level in the private dental office. The second indicates the supervision level in other settings such as independent dental practice, long-term facilities, hospitals, etc. on non-ambulatory patients.

| | AZ | CO | NM | OR | WA | WI | WY |
|---|----|----|----|-----|----|----|----|
| Place sutures | P | | | | | | |
| Apply cavity liners and bases | | N | | | | | |
| Place temporary restorations | N | N | | N/U | | N | N |
| Remove temporary restorations | N | N | | | | | |
| Place amalgam | | N | | P | P | | P |
| Carve amalgam | | N | | P | P | | P |
| Finish amalgam | | N | | P | P | | N |
| Polish amalgam | N | N | N | N/U | U | | N |
| Place and finish composite resin silicate restore | | N | | P | P | | P |

Source: http://www.adha.org/governmental_affairs/practice_issues.htm (August 2008)

Key:

P = physical presence of dentist is required

N = physical presence of dentist is not required

U = neither physical presence of dentist nor authorization by dentist required but there may be a requirement for some type of collaborative arrangement with a dentist, or some type of experience/special requirement by RDH.

/ = Where two letters are present in a box, the first indicates the supervision level in the private dental office. The second indicates the supervision level in other settings such as independent dental practice, long-term facilities, hospitals, etc. on non-ambulatory patients.

Dental Hygienists: Supplemental information from state regulators

| | AZ | CO | NM | OR | WA | WI† | WY |
|-----------------------------------|---|-----|-------|--|---|-----|----|
| Direct Access | No <i>Access to children <18 allowed for screening and fluoride; and for other services if RDH has affiliated practice agreement with dentist</i> | Yes | Yes** | No <i>Certain populations can access services without dentist supervision under Limited Access Permit; Patients must be referred to dentist within one year</i> | No <i>Pilot program allows direct access for senior centers to DHs under general supervision of dentists</i> | Yes | No |
| Direct Reimbursement ⁺ | | | | | | | |
| Medicaid | Not Addressed* | Yes | Yes** | Not Addressed* | Unknown | Yes | No |
| Private | Unknown | Yes | Yes** | Unknown | Unknown | Yes | No |
| Diagnostic Authority | No | No | No | No <i>Can diagnose for hygiene services, but must be authorized by dentist</i> | No | No | No |

* Not addressed in state law or regulations, according to state source; indicated as allowed in ADHA website summary

** Subject to having collaborative relationship with a sponsoring dentist

† Wisconsin is not confirmed.

+ Direct Reimbursement: States that contain statutory or regulatory language allowing the state Medicaid department to directly reimburse dental hygienists for services rendered. Some of the state licensing sources were unsure how their reimbursement was regulated since Medicaid reimbursement is often handled by separate agencies.

Table I.4. Nurse Practitioner Scope of Practice: 7-State Comparison

| | Oversight Requirements | | | | Practice Authorities | | | Prescribing Authorities | | | | National Certification Required |
|--------|-------------------------|----------------------|------------------------|---------------------------------|--------------------------------|-----------------------------------|-----------------------------|----------------------------------|---------------------------------|---------------------------|---------------------------------|---------------------------------|
| | No MD Involvement Req'd | MD Supervision Req'd | MD Collaboration Req'd | Written Practice Protocol Req'd | Explicit Authority to Diagnose | Explicit Authority to Order Tests | Explicit Authority to Refer | Authority without MD involvement | Authority with MD certification | Written Protocol Required | Authority Controlled Substances | |
| AZ | X | | | | X | X | X | X | | | X | X |
| CO | | | | | X | X [5] | X | | X | X | X | - |
| NM | X | | | | X | X | X | X | | | X | X |
| OR | X | | | | X | X | X | X | | | X | [1] |
| WA | X | | | | X | X | X | X | | | X | X |
| WI[2] | | | | | | | | | | | | |
| WY [4] | X | | | | [6] | X | X | [4] | | | [4] | X |

Sources: University of California, San Francisco, Center for the Health Professions (2007); State regulatory agency contacts

http://www.futurehealth.ucsf.edu/pdf_files/Chart%20of%20NP%20Scopes%20Fall%202007.pdf

- [1] Not required for state licensing, but practically necessary in order for independent practitioners to receive reimbursement from Medicaid and Medicare
- [2] Wisconsin recognizes two types of nurses that may be compared to Nurse Practitioners in other states -- one (NP) under the broader category of Advanced Practice Nurses, another called Advanced Practice Nurse Prescribers (APNP). The former group is not licensed by the state.
- [3] Limited Schedule II authorities, e.g., no amphetamines
- [4] WY rules are being updated to reflect current statutory authorities. NPs may apply for authority to prescribe (Schedule II-V) in areas of expertise after attaining 30 CEUs in pharmacology and 400 hrs as an APN
- [5] Colorado; test ordering authority not cited in UCSF table; included in draft table provided
- [6] Waiting to hear back from Wyoming contact

Table I.5. Statutory and Regulatory Requirements for Physician Assistant Licensure: 7-State Comparison

| | Prescriptive Authority | Graduation from PA school required | Bachelor's degree required | Current NCCPA certification [1] | Renewal Requirements | Regulatory body strictly for PAs | PAs per MD |
|------------|------------------------|------------------------------------|----------------------------|---------------------------------|----------------------|----------------------------------|------------|
| Arizona | X | X | - | X [2] | CME | X | 2 |
| Colorado | X | X [3] | - | - | - | - | 2 |
| New Mexico | X | X | - | X | NCCPA | - | * |
| Oregon | X | X | - | X [2] | NCCPA[4] | - | 4 [5] |
| Washington | X | X | - | X | CME | - | 3 |
| Wisconsin | X | X | - | X [2] | - | - | 2 [6] |
| Wyoming | X | X | - | X | NCCPA | - | 3 |

Source: <http://www.aapa.org/gandp/StateLawsandRegulations.htm>; State regulatory agency contact

* A physician may supervise "as many PAs as physician can effectively supervise and communicate with, appropriate to the practice setting" [Title 16, Chapter 10 Part 10, 15.11; Medicine and Surgery Practitioners – Physician Assistants]

[1] States requiring PAs seeking licensure to have a current NCCPA certificate.

[2] Required for initial license but not renewal

[3] "Or equivalent"

[4] For Schedule II prescribing only

[5] Physician may supervise 4 PAs; PA may have 4 supervising physicians. In rural or underserved areas, physician may apply to the board for approval to supervise more than 4 PAs and PA may apply to the board for approval to have more than 4 supervising physicians. [Oregon Revised Statutes, Chapter 677]

[6] No physician may supervise concurrently more than two PAs unless the physician submits and the Board approves a written plan. A PA may be supervised by more than one physician,

REFERENCE INFORMATION

| State | Department | Contact name | Phone | Website |
|-------|---|-------------------|--------------|---|
| AZ | Board of Nursing | Mary Rappaport | 602-889-5184 | http://www.azmd.gov/ |
| | Regulatory Board of Physician Assistants | Roger Downey | 877-255-2212 | http://www.azpa.gov/ |
| | Board of Dental Examiners | n/a (1) | 602-242-1492 | http://www.azdentalboard.org/ |
| NM | Board of Nursing | Debra Werner | 505-841-9084 | http://www.bon.state.nm.us/ |
| | Medical Board | Amanda Quintana | 505-476-7220 | http://www.nmmb.state.nm.us/ |
| | Dental Hygienist Committee | Anita Villegas | 505-476-4680 | http://www.rld.state.nm.us/Dental/index.html |
| OR | Board of Nursing | Tracy Klein | 971-673-0685 | http://www.osbn.state.or.us/ |
| | Medical Board | Michele Provinsal | 971-673-2700 | http://www.oregon.gov/OMB/index.shtml |
| | Board of Dentistry | Theresa Haynes | 971-673-3200 | http://www.oregon.gov/Dentistry/ |
| WA | Nursing Care Quality Assurance Commission | Cecily Markham | 360-236-4725 | https://fortress.wa.gov/doh/hpqa1/hps6/nursing/default.htm |
| | Medical Care Quality Assurance Commission | Bob Horner | 360-236-2765 | https://fortress.wa.gov/doh/hpqa1/hps5/Medical/default.htm |
| | Dental Hygiene Examining Committee | Sandy Pierson | 360-236-4862 | https://fortress.wa.gov/doh/hpqa1/hps3/Dental_Hygiene/default.htm |
| WI | Department of Regulation and Licensing | Colleen Baird | 608-266-1815 | http://drl.wi.gov/index.htm |
| WY | Board of Nursing | Mary Beth Stepens | 307-777-7601 | http://nursing.state.wy.us/ |
| | Board of Medicine | Carrie Drummond | 307-778-7053 | http://wyomedboard.state.wy.us/index.asp |
| | Board of Dental Examiners | Debra Bridges | 307-777-6529 | http://plboards.state.wy.us/dental/complaint.asp |

Appendix J

Regulatory Framework for Select Health Professions in Colorado

PHYSICIAN ASSISTANT SCOPE OF PRACTICE IN COLORADO²⁷

The scope of practice of a Physician Assistant (PA) is specified in the Colorado Medical Practice Act, Colorado Revised Statutes, Title 12; Article 36.

Physician Assistant

A person licensed to practice medicine may delegate to a licensed PA the authority to perform acts that constitute the practice of medicine, including the authority to prescribe medication, including controlled substances. Each prescription issued by a PA must be imprinted with the name of his/her supervising physician.

Definition of the practice of medicine

- The practice of medicine is defined as being able to diagnose, treat, prescribe for, palliate, or prevent any human disease, ailment, pain, injury, deformity, or physical or mental condition, whether by the use of drugs, surgery, manipulation, electricity, telemedicine, the interpretation of tests.
- In addition, the practice of medicine is suggesting, recommending, prescribing or administering any form of treatment, operation, or healing for the intended palliation, relief or cure of any physical or mental disease, ailment, injury, condition or defect of any person with the intent of receiving any form of compensation.

A physician may personally supervise no more than two PAs. The extent of this supervision shall be determined by the Board of Medical Examiners (BOME). By statute, the physician's physical presence is not required if:

- Care is given in an acute care hospital where the supervising physician regularly practices or in a designated health manpower shortage area
- The physician reviews the quality of care given by the PA every two working days to ensure compliance with physicians' directions.

Additionally, the Board has adopted rules that allow PAs to practice without the physical presence of a physician in a variety of practice settings.

Licensure

The BOME is responsible for overseeing the licensure of PAs. Licensing requirements for PAs include:

- Completion of an education program approved by the BOME
- Passing of a national certifying examination for assistants to the primary care physician
- Application to the BOME and paid appropriate fees
- Attained the age of 21 years

The BOME may take the same disciplinary action with respect to a PA license as it may with a physician license.

²⁷ Colorado Medical Practice Act, 2007

A licensed PA may not perform any act that constitutes the practice of medicine within a licensed hospital or nursing care facility without authorization from the governing board of the hospital or nursing care facility. The facility's governing board has the authority to grant, deny, or limit such authority to its own established procedures.

ADVANCED PRACTICE NURSE SCOPE OF PRACTICE IN COLORADO²⁸

The scope of practice of an Advanced Practice Nurse (APN) is addressed under the Colorado Nurse Practice Act, Colorado Revised Statutes, Title 12, Article 38.

An "advanced practice nurse" is a professional nurse who is licensed to practice pursuant to the nurse practice act and obtains specialized education or training. The Board of Nursing (BoN) has established the advanced practice registry. The BoN requires that a nurse applying for registration identify their area of specialty. A nurse who is included in the advanced practice registry has the right to use the title "advanced practice nurse" or, if authorized by the BoN, to use the title "certified nurse midwife", "clinical nurse specialist", "certified registered nurse anesthetist", or "nurse practitioner". These titles may be abbreviated as "A.P.N.", "C.N.M.", "C.N.S.", "C.R.N.A.", or "N.P.", respectively.

On and after July 1, 1995 until July 1, 2008, the requirements for the advanced practice registry include the successful completion of a nationally accredited APN education program or a passing score on a certification examination of a nationally recognized accrediting agency, or both, if applicable, as defined in rules adopted by the board.

On and after July 1, 2008, the requirements for the advanced practice registry include the successful completion of a graduate degree in the appropriate specialty. For individuals who are included in the registry as of June 30, 2008, but have not successfully completed graduate program, they may continue to be included in the registry and to use the appropriate title and abbreviation.

An APN may receive prescriptive authority and can prescribe controlled substances or prescription drugs to provide treatment for patients requiring routine health maintenance/preventive care, acute self-limiting conditions, stabilized chronic care, and terminal comfort care. It is limited to those patients within the APN's scope of practice. To apply for prescriptive authority, APNs need:

- A graduate degree in a nursing specialty;
- Completed specific educational requirements in the use of controlled substances and prescription drugs;
- Clinical post-graduate experience as an APN of not less than 1800 hours within the immediately preceding five (5) years; and,
- A written collaborative agreement with a physician whose medical education, training, experience and active practice corresponds with the APN.

CRNAs are not required to obtain prescriptive authority to deliver anesthesia care. The Colorado Nurse Practice Act does not require supervision by a physician and APNs may use independent judgment as it pertains to their scope of practice. However, the practice act clearly states that APNs may not practice medicine independently (as defined by the Medical Practice Act).

²⁸ Colorado Nurse Practice Act, 2007

DENTAL HYGIENIST SCOPE OF PRACTICE IN COLORADO²⁹

The scope of practice of a Dental Hygienist (DH) is specified in the Dental Practice Act of Colorado, Colorado Revised Statutes, Title 12; Article 35.

Dental hygiene is the delivery of preventive, educational and clinical services supporting total health for the control of oral disease and the promotion of oral health provided by a DH.

A DH may practice under any of three levels of autonomy:

- Direct supervision which requires the presence of a dentist on the premise, but not necessarily in the room;
- Indirect supervision which requires that the tasks be performed with the prior knowledge and consent of a dentist but no physical presence is required; and,
- Unsupervised which does not require any involvement by a licensed dentist.

Unsupervised dental hygiene services may be performed by licensed dentists and licensed dental hygienists. These services include: removing deposits, accretions, and stains from all surfaces of the tooth; removing granulation and degenerated tissue through the process of gingival curettage; providing preventive oral health measures; assembling patient record information and administering a topical anesthetic.

An unsupervised dental hygienist may be the proprietor of a place where supervised or unsupervised dental hygiene is performed. They may purchase, own, or lease equipment needed to perform dental hygiene.

Services that can be provided by a supervised DH include the above, plus: radiographic and x-ray survey; curettage that includes the incidental removal of live epithelial tissue; root planing; and preparation of study casts. Only a direct supervised DH may administer local anesthetic.

The Dental Practice Law of Colorado stipulates that a DH may perform any procedures assigned to them by a licensed dentist that does not require the professional skill of dentist. A dentist **MAY NOT** assign a DH any dental procedure that may result in an irremediable alteration of the oral anatomy, nor responsibility for diagnosis, treatment planning, or the prescription of therapeutic measures.

Licensure

To receive a license, a DH must file an application with the State Board of Dental Examiners and provide proof of graduation from an accredited school of dental hygiene with a program of at least two years duration. If a person has not graduated within the last 12 months or has not been practicing or teaching DH in an accredited program for at least one year of the last five, the applicant must demonstrate that he/she has maintained professional ability and knowledge.

Applicants for licensure also must pass three exams:

1. An exam administered by the joint commission on national dental examinations
2. An exam testing the applicant's clinical skills and knowledge, administered by a regional testing agency or another state
3. An exam on the provisions of the Dental Practice Law

²⁹ Dental Practice Law of Colorado, 2007

Endnotes

- ¹ CIPHER, D., and R. Hooker. (2006). "Prescribing trends by nurse practitioners and physician assistants in the United States." *Journal of the American Academy of Nurse Practitioners* 18: 291-96.
- ² Ohman-Strickland, P., et al. (2008). "Quality of diabetes care in family medicine practices: Influence of NPs and PAs." *Annals of Family Medicine* 6(1):14-22.
- ³ Ibid.
- ⁴ Enns, S., R. Muma and M. Lary. (2000). "Examining referral practices of primary care physician assistants." *Journal of the American Academy of Physician Assistants* 13(5):81-87.
- ⁵ Anderson, D., and M. Hampton. (1999). "Physician assistants and nurse practitioners: Rural-urban settings and reimbursement for services." *The Journal of Rural Health* 15(2): 252-262
- ⁶ Grumbach, K., et al. (2003). "Who is caring for the underserved? A comparison of primary care physicians and nonphysician clinicians in California and Washington." *Annals of Family Medicine* 1(2): 97-104.
- ⁷ Brown, S., and D. Grimes. (1995). "A meta-analysis of nurse practitioners and nurse midwives in primary care." *Nursing Research* 44(8): 32-39.
- ⁸ Horrocks, S., E. Anderson and C. Salisbury. (2002). "Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors." *British Medical Journal* 324 (2002): 819-823.
- ⁹ Relevant studies include: Lenaway, et al.; Ohman-Strickland, et al. Munding, et al. (2000 and 2004); Litaker, et al.; Hamric, et al.; Laurant, et al.; Brown, et al.; Oakley, et al.; Simonson, et al.; and Pine, et al.
- ¹⁰ Ibid.
- ¹¹ Venning. "Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care."
- ¹² Ibid.
- ¹³ Litaker, D., et al. (2003). "Physician-nurse practitioner teams in chronic disease management: The impact on costs, clinical effectiveness and patients' perception of care." *Journal of Interprofessional Care* 17 (3): 223-234.
- ¹⁴ Ibid.
- ¹⁵ Oakley, D., et al. (1996). "Comparison of outcomes of maternity care by obstetricians and certified nurse midwives." *Outcomes of Care* 88(5): 823-29.
- ¹⁶ Lenaway, D., et al. (1998). "Evaluation of a public-private certified nurse-midwife maternity program for indigent women." *American Journal of Public Health* 88(4):675-79.
- ¹⁷ Grumbach. (2003). "Who is caring for the underserved?"
- ¹⁸ Simonson, D., M. Ahern and M. Hendryx. (2007). "Anesthesia staffing and anesthetic complications during Cesarean delivery: A retrospective analysis." *Nursing Research* 56(1): 9-17.
- ¹⁹ See Appendix # for the literature bibliography
- ²⁰ Researchers were not able to recruit a comparison group of dental practices willing to participate. Therefore, a convenience sample of dental practices was identified wherein independent evaluators reviewed dental records provided by a governmental agency and private insurance company during the same period.
- ²¹ Evidence must exist in the record that there had been adequate follow-up based on affirmative answers to medical questions indicating that it was safe to proceed with dental care.
- ²² Donaldson, M., et al. (1996). *Primary Care: America's Health in a New Era*. Committee on the Future of Primary Care, Division of Health Care Services, Institute of Medicine. Washington, DC: National Academy Press.
- ²³ National Cancer Institute. "Dictionary of Cancer Terms." Retrieved December 8, 2008, from http://www.cancer.gov/Templates/db_alpha.aspx?CdriD=44712.
- ²⁴ University of Miami Medical Group. "What is primary care?" Retrieved December 8, 2008, from <http://www.med.miami.edu/ummg/x75.xml>.
- ²⁵ Safran, D. (2003). "Defining the future of primary care: What can we learn from patients?" *Annals of Internal Medicine* 138: 248-55.
- ²⁶ Howie J., D. Heaney and M. Maxwell. (2004). "Quality, core values and the general practice consultation: Issues of definition, measurement and delivery." *Family Practice*. 21: 458-68.
- ²⁷ Osler, W. (1982). "Remarks on specialism." *Boston Medical and Surgical Journal* 126: 457-59.
- ²⁸ White, K., T. Williams and B. Greenberg. (1961). "The ecology of medical care." *New England Journal of Medicine* 265(18): 885-93.

-
- ²⁹Mullan, F. (1998). "The 'Mona Lisa' of health policy: Primary care at home and abroad." *Health Affairs* 17(2): 118-26.
- ³⁰Ibid.
- ³¹U.S. Department of Labor, Bureau of Labor Statistics. *Occupational Outlook Handbook, 2008-09 Edition*. Retrieved December 8, 2008, from <http://www.bls.gov/oco/ocos074.htm>.
- ³²Association of American Medical Colleges. (1997). "Statistical information related to medical education." *AAMC Data Book*. Table B13.
- ³³Newton, D., and M. Grayson. (2003). "Trends in career choice by U.S. medical school graduates." *Journal of the American Medical Association* 290: 1179-82.
- ³⁴Sack, Kevin. (2008). "In Massachusetts, universal coverage strains care." *New York Times*. April 5, 2008.
- ³⁵Starfield, (2002). *Primary Care: Concept, Evaluation and Policy*. Oxford University Press: New York.
- ³⁶McPhee, S.J., et al. (1984). "How good is communication between primary care physicians and subspecialty consultants?" *Archives of Internal Medicine* 144: 1265-68.
- ³⁷Shi, L., et al. (1999). "Income inequality, primary care and health indicators." *Journal of Family Practice* 48:275-84.
- ³⁸Vogel, R., and R. Ackermann. (1998). "Is primary care physician supply correlated with health outcomes?" *International Journal of Health Services* 28:183-96.
- ³⁹Shi, L. (1992). "The relationship between primary care and life chances." *Journal of Health Care for the Poor and Underserved* 3:321-35.
- ⁴⁰Shi, L. (1994). "Primary care, specialty care and life chances." *International Journal of Health Services* 24:431-58.
- ⁴¹Shi. "Income inequality."
- ⁴²Ibid.
- ⁴³Campbell, R., et al. (2003). "Cervical cancer rates and the supply of primary care physicians in Florida." *Family Medicine* 35:60-64.
- ⁴⁴Safran. "Defining the future of primary care."
- ⁴⁵Franks, P., and K. Fiscella K. (1998). "Primary care physicians and specialists as personal physicians. Health care expenditures and mortality experience." *Journal of Family Practice* 47: 105-9.
- ⁴⁶Shi, L., et al. (2005). "Primary care, social inequalities and all-cause, heart disease and cancer mortality in U.S. counties: A comparison of urban and rural areas." *Public Health* 119: 699-710.
- ⁴⁷Macinko, J., B. Starfield and L. Shi. (2005). "Quantifying the health benefits of primary care physician supply in the United States." Unpublished manuscript.
- ⁴⁸Flocke, S., K. Stange and S. Zyzanski. (1998). "Association of attributes of primary care with the delivery of clinical preventive services." *Medical Care* 36:21-30.
- ⁴⁹Ryan, S., et al. (2001). "Effects of regular source of care and health need on medical care use among rural adolescents." *Archives of Pediatric and Adolescent Medicine* 155:184-90.
- ⁵⁰Fisher, E., D. Goodman and A. Chandra. (2008). "Regional and racial variation in health care among Medicare beneficiaries: A brief report of the Dartmouth Atlas Project." *Robert Wood Johnson Foundation Report*.
- ⁵¹Ibid.
- ⁵²Wagner, E. (2000). "The role of patient care teams in chronic disease management." *British Medical Journal* 320:569-72.
- ⁵³Grumbach, K., and T. Bodenheimer. (2004). "Can health care teams improve primary care practice?" *Journal of the American Medical Association* 291(10):1246-51.
- ⁵⁴Bettenhausen, K. (1991). "Five years of group research: What we have learned and what needs to be addressed." *Journal of Management* 17: 345-81.
- ⁵⁵Gully, S., D. Devine and D. Whitney. (1995) "A meta-analysis of cohesion and performance." *Small Group Research* 26:497-520.
- ⁵⁶Cannon-Bowers, J., R. Oser and D. Flanagan D. (1992). "Work teams in industry: A selected review and proposed framework. In: Swezey, R.W., and E. Salas, eds. *Teams: Their Training and Performance*. Norwood, NJ: Ablex Publishing.
- ⁵⁷Vinokur-Kaplan, D. (1995). "Enhancing the effectiveness of interdisciplinary mental health treatment teams." *Administration and Policy in Mental Health* 22:521-30.
- ⁵⁸Fried, B., T. Rundall and S. Topping. (2000). "Groups and teams in health services organizations. In: Shortell, S.M., and A.D. Kaluzny, eds. *Health Care Management*. Albany, NY: Delmar Thomson Learning.

-
- ⁵⁹ Stevenson, K., et al. (2001). "Features of primary health care teams associated with successful quality improvement of diabetes care." *Family Practice* 18:21-26.
- ⁶⁰ Campbell S., et al. (2001). "Identifying predictors of high quality care in English general practice: Observational study." *British Medical Journal* 323: 1-6.
- ⁶¹ Goni, S. (1999). "An analysis of the effectiveness of Spanish primary care teams." *Health Policy*, 48: 107-17.
- ⁶² Roblin, D., et al. (2002). "Collaborative clinical culture and primary care outcomes. In: Program and abstracts of the annual meeting of the Academy for Health Services Research and Quality.
- ⁶³ Roblin, D., et al. (2004). "Use of midlevel practitioners to achieve labor cost savings in the primary care practice of an MCO." *Health Services Research* 39 (3): 607-26.
- ⁶⁴ Scheffler, R., N. Waitzman and J. Hillman. (1996). "The productivity of physician assistants and nurse practitioners and health work force policy in the era of managed healthcare." *Journal of Allied Health* 25: 207-17.
- ⁶⁵ Flood, A., et al. (1998). "How do HMOs achieve savings? The effectiveness of one organization's strategies." *Health Services Research* 33: 79-99.
- ⁶⁶ Grzybicki, D., et al. (2002). "The economic benefit for family/general practices employing physician assistants." *American Journal of Managed Care* 8: 613-20.
- ⁶⁷ Hooker, R. (2002). "A cost analysis of physician assistants in primary care." *Journal of the American Academy of Physician Assistants* 15:39-42, 45, 48.
- ⁶⁸ Venning, P., et al. (2000). "Randomized controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care." *British Medical Journal* 320: 1048-53.
- ⁶⁹ American College of Physicians. Retrieved December 8, 2008, from http://www.acponline.org/hpp/statehc06_1.pdf.
- ⁷⁰ Wagner, E. (2000). "The role of patient care teams in chronic disease management." *British Medical Journal* 320: 569-72.
- ⁷¹ DeBusk, F., et al. (1994). "A case management system for coronary risk factor modification after acute myocardial infarction." *Annals of Internal Medicine* 120: 721-29.
- ⁷² Aubert, R., et al. (1998). "A randomized controlled trial of nurse case management within an HMO to improve glycemic control in patients with diabetes." *Annals of Internal Medicine* 129:605-21.
- ⁷³ Wagner, E., et al. (2001). "Quality improvement in chronic illness care: A collaborative approach." *Joint Commission Journal on Quality Improvement* 27:63-80.
- ⁷⁴ Sommers, L., et al. (2000). "Physician, nurse and social worker collaboration in primary care for chronically ill seniors." *Archives of Internal Medicine* 160:1825-33.
- ⁷⁵ American College of Physicians-American Society of Internal Medicine. (2002). "Pharmacist scope of practice." *Annals of Internal Medicine* 136:79-85.
- ⁷⁶ Hanlon, J., et al. (1996). "A randomized, controlled trial of a clinical pharmacist intervention to improve inappropriate prescribing in elderly outpatients with polypharmacy." *American Journal of Medicine* 100:428-37.
- ⁷⁷ Bogden, P., et al. (1998). "Comparing standard care with a physician and pharmacist team approach for uncontrolled hypertension." *Journal of General Internal Medicine* 13:740-45.
- ⁷⁸ Gattis, W., et al. (1999). "Reduction in heart failure events by the addition of a clinical pharmacist to the heart failure team." *Archives of Internal Medicine* 159:1939-45.
- ⁷⁹ Leape, L., et al. (1999). "Pharmacist participation on physician rounds and adverse drug events in the intensive care unit." *Journal of the American Medical Association* 282:267-70.
- ⁸⁰ Halstead, L. (1976). "Team care in chronic illness: A critical review of the literature of the past 25 years." *Archives of Physical Medicine and Rehabilitation* 57:507-11.
- ⁸¹ Wells, K., et al. (2000). "Impact of disseminating quality improvement programs for depression in managed primary care: A randomized controlled trial." *Journal of the American Medical Association* 283:212-20.
- ⁸² Goitein, M. (1990). "Waiting patiently." *New England Journal of Medicine* 323:604-8.
- ⁸³ Kaiser Family Foundation. (2000). *National Survey of Consumer Experiences with Health Plans*. Retrieved December 19, 2008, from <http://www.kff.org/insurance/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=13510>.
- ⁸⁴ Strunk, B., and P. Cunningham. (2002). *Treading Water: Americans' Access to Needed Medical Care, 1997-2001*. Tracking Report No. 1. Center for Studying Health System Change. Retrieved December 19, 2008, from <http://www.hschange.com/CONTENT/421/>.
- ⁸⁵ Ibid.

-
- ⁸⁶ Murray, M., and D. Berwick. (2003). "Advanced access: Reducing waiting and delays in primary care." *Journal of the American Medical Association* 289 (8):1035-40.
- ⁸⁷ Dixon, S., et al. (2006). "Advanced access: More than GP waiting times?" *Family Practice* 23(2): 233-39.
- ⁸⁸ Bundy, D., et al. (2005). "Open access in primary care: Results of a North Carolina pilot project." *Pediatrics* 116: 82-87.
- ⁸⁹ Murray, M., and C. Tantau. (2000). "Same-day appointments: Exploding the access paradigm." *Family Practice Management* 7:45-50.
- ⁹⁰ Singer, I. (2001). *Advanced Access: A New Paradigm in the Delivery of Ambulatory Care Services*. Washington, DC: National Association of Public Hospitals and Health Systems. Retrieved December 29, 2008, from <http://www.naph.org/naph/publications/AdvancedAccess.pdf>.
- ⁹¹ O'Connor, M., and B. Matthews. (2006). "Effect of open access scheduling on missed appointments, immunizations and continuity of care for infant well-child care visits." *Archives of Pediatrics & Adolescent Medicine* 160(9):889-93.
- ⁹² Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. (1997). "The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure." *Archives of Internal Medicine* 157:2413-46.
- ⁹³ Clark, C., et al. (2000). "Promoting early diagnosis and treatment of Type 2 diabetes." *Journal of the American Medical Association* 284:363-65.
- ⁹⁴ Perez-Stable, E., and E. Fuentes-Afflick. (1998). "Role of clinicians in cigarette smoking prevention." *Western Journal of Medicine* 169:23-29.
- ⁹⁵ McBride, P., et al. (1998). "Primary care practice adherence to national cholesterol education program guidelines for patients with coronary heart disease." *Archives of Internal Medicine* 158:1238-44.
- ⁹⁶ Ni, H., D. Nauman and R. Hershberger. (1998). "Managed care and outcomes of hospitalization among elderly patients with congestive heart failure." *Archives of Internal Medicine* 158:1231-36.
- ⁹⁷ Samsa, G., et al. (2000). "Quality of anticoagulation management among patients with atrial fibrillation." *Archives of Internal Medicine* 160:967-73.
- ⁹⁸ Legorreta, A., et al. (2000). "Variation in managing asthma: Experience at the medical group level in California." *American Journal of Managed Care* 6:445-53.
- ⁹⁹ Young, A., et al. (2001). "The quality of care for depressive and anxiety disorders in the United States." *Archives of General Psychiatry* 58:55-61.
- ¹⁰⁰ Grumbach, K., and T. Bodenheimer. (2002). "A primary care home for Americans: Putting the house in order." *Journal of the American Medical Association* 288:889-93.
- ¹⁰¹ Bodenheimer, T., E. Wagner and K. Grumbach. (2002). "Improving primary care for patients with chronic illness." *Journal of the American Medical Association* 288(14):1775-79.
- ¹⁰² Wagner, E. (1998). "Chronic disease management: What will it take to improve care for chronic illness?" *Effective Clinical Practice* 1:2-4.
- ¹⁰³ Wagner, E., et al. (2001). "Improving chronic illness care: Translating evidence into action." *Health Affairs* 20:64-78.
- ¹⁰⁴ Lorig, K. (1993). "Self-management of chronic illness: A model for the future." *Generation* 17:11-14.
- ¹⁰⁵ Bodenheimer. "Improving primary care for patients with chronic illness."
- ¹⁰⁶ Wagner. "Chronic disease management" AND Wagner, "Improving chronic illness care."
- ¹⁰⁷ Wagner. "Improving chronic illness care."
- ¹⁰⁸ Bodenheimer. "Improving primary care for patients with chronic illness."
- ¹⁰⁹ Wagner. "Chronic disease management."
- ¹¹⁰ Wagner. "Improving chronic illness care."
- ¹¹¹ Sadur, C., et al. (1999). "Diabetes management in a Health Maintenance Organization. Efficacy of care management using cluster visits." *Diabetes Care* 22: 2011-17.
- ¹¹² Davis, D., et al. (1995). "Changing physician performance." *Journal of the American Medical Association* 274:700-05.
- ¹¹³ Sperl-Hillen, J., et al. (2000). "Improving diabetes care in a large health care system: An enhanced primary care approach." *Joint Commission Journal on Quality Improvement* 26:615-22.
- ¹¹⁴ Bodenheimer, T. (2003). "Innovations in primary care in the U.S." *British Medical Journal* 326 (7393): 796-99.
- ¹¹⁵ Gotler, R., et al. (2000). "Facilitating participatory decision-making: What happens in real world community practice?" *Medical Care* 38:1200-09.

-
- ¹¹⁶ Anderson, R., and M. Funnell. (2000). "Compliance and adherence are dysfunctional concepts in diabetes care." *The Diabetes Educator* 26:597-604.
- ¹¹⁷ Bodenheimer, T., et al. (2002). "Patient self-management of chronic disease in primary care." *Journal of the American Medical Association* 288:2469-75.
- ¹¹⁸ Ibid.
- ¹¹⁹ Ibid.
- ¹²⁰ Katon, W., et al. (2004). "The Pathways Study: A randomized trial of collaborative care in patients with diabetes and depression." *Archives of General Psychiatry* 61(10):1042-49.
- ¹²¹ Beck, A., et al. (1997). "A randomized trial of group outpatient visits for chronically ill older HMO members." *Journal of the American Geriatrics Society* 45:543-49.
- ¹²² Clancy, D., et al. (2003). "Evaluating concordance to American Diabetes Association standards of care for Type 2 Diabetes through group visits in an uninsured or inadequately insured patient population." *Diabetes Care* 26: 2032-36.
- ¹²³ Bodenheimer. "Innovations in primary care in the U.S."
- ¹²⁴ Ibid.
- ¹²⁵ Beck. "A randomized trial of group outpatient visits for chronically ill older HMO members."
- ¹²⁶ Ibid.
- ¹²⁷ Bodenheimer. (2003). "Innovations in primary care in the U.S."
- ¹²⁸ Adams, W., A. Mann and H. Bauchner. (2003). "Use of an electronic medical record improves the quality of urban pediatric primary care." *Pediatrics* 111: 626-32.
- ¹²⁹ Ibid.
- ¹³⁰ Balas, E., et al. (2000). "Improving preventive care by prompting physicians." *Archives of Internal Medicine* 160:301-08.
- ¹³¹ Wang, S., et al. (2003). "A cost-benefit analysis of electronic medical records in primary care" *The American Journal of Medicine* 114(5): 397-403.
- ¹³² Overhage, J., et al. (2002). "A randomized, controlled trial of clinical information shared from another institution." *Annals of Emergency Medicine* 39:14-23.
- ¹³³ Cooper, R., T. Henderson and C. Dietrich. (1998). "Roles of nonphysician clinicians as autonomous providers of patient care." *Journal of the American Medical Association* 280: 795-802.
- ¹³⁴ Colorado Medical Practice Act, Effective July 1, 2007. Retrieved December 29, 2008, from <http://www.dora.state.co.us/medical/Statute.pdf>
- ¹³⁵ American Academy of Physician Assistants (AAPA). "Information about PAs and the PA profession." Retrieved March 4, 2008, from <http://www.aapa.org/geninfo1.html>.
- ¹³⁶ Mittman, D., J. Cawley and W. Fenn. (2002). "Physician assistants in the United States." *British Medical Journal* 325:485-87.
- ¹³⁷ Colorado Department of Regulatory Agencies. *The Examiner*. Retrieved November 6, 2008, from <http://www.dora.state.co.us/medical/forms/Examiner0406.pdf>.
- ¹³⁸ The Child Health Associate Physician Assistant program offered by the University of Colorado is a 33-month program that includes a summer break when students can choose to add a clinical rotation.
- ¹³⁹ Accreditation Review Commission on Education for the Physician Assistant, Inc. Retrieved December 8, 2008, from <http://www.arc-pa.org/Standards/3rdeditionwithPDchangesandregionals4.24.08a.pdf>.
- ¹⁴⁰ AAPA. "Information about PAs and the PA profession." Retrieved November 6, 2008, from <http://www.aapa.org/geninfo1.html>.
- ¹⁴¹ AAPA. (2008). *2008 AAPA Physician Assistant Census Report*. Retrieved November 5, 2008, from <http://www.aapa.org/research/SpecialtyReports08/FamilyMedicine08C.pdf>.
- ¹⁴² Bricker and Eckler LLP. (2006). "Ohio's New Physician Assistant Law." *Health Care Client Bulletin No. 06-01*.
- ¹⁴³ AAPA. "Information about PAs and the PA profession." Retrieved November 19, 2008, <http://www.aapa.org/geninfo1.html>.
- ¹⁴⁴ Colorado Medical Practice Act (2007). Retrieved December 29, 2008, from <http://www.dora.state.co.us/medical/Statute.pdf>
- ¹⁴⁵ CIPHER, D., and R. Hooker. (2006). "Prescribing trends by nurse practitioners and physician assistants in the United States." *Journal of the American Academy of Nurse Practitioners* 18: 291-96.

-
- ¹⁴⁶ Ohman-Strickland, P., et al. (2008). "Quality of diabetes care in family medicine practices: Influence of NPs and PAs." *Annals of Family Medicine* 6(1):14-22.
- ¹⁴⁷ Ibid.
- ¹⁴⁸ Enns, S., R. Muma and M. Lary. (2000). "Examining referral practices of primary care physician assistants." *Journal of the American Academy of Physician Assistants* 13(5):81-87.
- ¹⁴⁹ Anderson, D., and M. Hampton. (1999). "Physician assistants and nurse practitioners: Rural-urban settings and reimbursement for services." *The Journal of Rural Health* 15(2): 252-262.
- ¹⁵⁰ Grumbach, K., et al. (2003). "Who is caring for the underserved? A comparison of primary care physicians and nonphysician clinicians in California and Washington." *Annals of Family Medicine* 1(2): 97-104.
- ¹⁵¹ Phillips, R., et al. (2002). "Can nurse practitioners and physicians beat parochialism into plowshares?" *Health Affairs* 21:133-42.
- ¹⁵² AAPA, (1998) *General Census Report*. Retrieved December 29, 2008, from <http://www.aapa.org/research/sum98.html>
- ¹⁵³ Running, A., et al. (2000). "A survey of nurse practitioners across the United States." *The Nurse Practitioner* 25: 110-16.
- ¹⁵⁴ Brown, D. (2007). "Consumer perspectives on nurse practitioners and independent practice." *Journal of the American Academy of Nurse Practitioners* 19: 523-39.
- ¹⁵⁵ Venning, P., et al. (2000). "Randomized control trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care." *British Medical Journal* 320: 1048-53.
- ¹⁵⁶ American Nurses Credentialing Center. Retrieved October 28, 2008, from <http://www.nursecredentialing.org/Certification.aspx>.
- ¹⁵⁷ American Association of Colleges of Nursing. (2004). "AACN position statement on the practice doctorate in nursing." Retrieved November 11, 2008, from <http://www.aacn.nche.edu/DNP/DNPPositionStatement.htm>.
- ¹⁵⁸ Williams, D. (1999). "Preserving midwifery practice in a managed care environment." *Journal of Nurse-Midwifery* 44(4):375-82.
- ¹⁵⁹ Reed, C., and C. Selleck. (1996). "The role of midlevel providers in cancer screening." *Medical Clinics of North America* 80 (1):135-44.
- ¹⁶⁰ American College of Nurse Midwives (ACNM). "Certified nurse-midwives in Colorado." Retrieved March 18, 2008, from <http://www.midwife.org/display.cfm?id=373&CFID=1393878&CFTOKEN=39780798>.
- ¹⁶¹ ACNM. "Joint Statement of Practice Relations between Obstetrician-Gynecologists and Certified Nurse-Midwives/Certified Midwives." Approved October 1, 2002. At: <http://www.midwife.org>.
- ¹⁶² ACNM. "About the ACNM core competencies for basic midwifery practice." Retrieved November 24, 2008, from http://www.midwife.org/core_competencies.cfm.
- ¹⁶³ ACNM. "A comparison of certified nurse-midwives/certified midwives (CNMs/CMs) and certified professional midwives (CPMs)." Retrieved November 24, 2008, from http://www.midwife.org/siteFiles/legislative/CNM-CM-CPM_chart_FINAL_March_07.pdf.
- ¹⁶⁴ ACNM. "Continuing competency assessment." Retrieved November 24, 2008, from <http://www.midwife.org/cca.cfm>.
- ¹⁶⁵ ACNM. "Midwifery education programs." Retrieved November 24, 2008, from <http://www.midwife.org/map.cfm>.
- ¹⁶⁶ ACNM. Retrieved November 25, 2008, from <http://www.midwife.org>.
- ¹⁶⁷ <http://www.aana.com/Credentialing> accessed October 31, 2008.
- ¹⁶⁸ Dunbar, P., J. Mayer and M. Fordyce. (1998). "Availability of anesthesia personnel in rural Washington and Montana." *Anesthesiology* 88: 800-08.
- ¹⁶⁹ Orkin, F. (1998). "Rural realities." *Anesthesiology* 88: 568-71.
- ¹⁷⁰ Garde, J. (2000). "Report of the executive director." *American Association of Nurse Anesthetists. AANA News Bulletin* 54(11):11-14.
- ¹⁷¹ Seibert, E., J. Alexander and A. Lupien. (2004). "Rural nurse anesthesia practice: A pilot study." *American Association of Nurse Anesthetists Journal* 72 (3): 181-90.
- ¹⁷² Fallacaro, M., and T. Ruiz-Law. (2004). "Distribution of U.S. anesthesia providers and services." *American Association of Nurse Anesthetists Journal* 72(1): 9-14.
- ¹⁷³ Required clinical hours for certification are included in the accredited program and are documented in each applicant's transcript. Retrieved October 31, 2008, from <http://www.aana.com/>.

-
- ¹⁷⁴ American Association of Nurse Anesthetists (AANA). "Credentialing." Retrieved October 31, 2008, from <http://www.aana.com/>.
- ¹⁷⁵ AANA. "Comparison of certified registered nurse anesthetists (CRNAs) and anesthesiologist assistants (AAs). Retrieved November 20, 2008, from http://everhadgas.com/CRNA-AA_Comparison_Table_update_208.pdf.
- ¹⁷⁶ Ibid.
- ¹⁷⁷ In an October 1999 letter to the law firm of Miles, McLaren and Peters, the Office of the Colorado Attorney General noted that "...the delivery of anesthesia care by a nurse anesthetist rests soundly within the independent scope of CRNA practice."
- ¹⁷⁸ U.S. Department of Health and Human Services: Centers for Medicare and Medicaid. (2001). *Federal Register* Vol. 66 (219) 42 CFR Part 416: 482 and 485. Retrieved November 25, 2008, from <http://granteefind.hrsa.gov/searchbyprogram.aspx?select=H2A&index=206>.
- ¹⁷⁹ This was reported through email from the Agency for Healthcare Research and Quality's Outcomes Office on November 24, 2008.
- ¹⁸⁰ AANA. "Fact sheet concerning state opt-outs and November 13, 2001, CMS rule." Retrieved November 20, 2008, from http://www.aana.com/Advocacy.aspx?ucNavMenu_TSMenuTargetID=49&ucNavMenu_TSMenuTargetType=4&ucNavMenu_TSMenuID=6&id=2573.
- ¹⁸¹ Ibid.
- ¹⁸² Nursezone.com. "Nursing News: Colorado may opt out of CRNA supervision requirement." Retrieved November 20, 2008, from <http://www.nursezone.com/nursing-news-events/more-news.aspx?ID=10568>.
- ¹⁸³ State Board of Health Minutes, May 21, 2003.
- ¹⁸⁴ Ibid.
- ¹⁸⁵ amednews.com. (2003). "Colorado seeks to end doctor oversight of nurse anesthetist." Retrieved November 20, 2008, from <http://www.ama-assn.org/amednews/2003/10/13/prsb1013.htm>.
- ¹⁸⁶ Colorado Rural Health Center. (2006). "State governor's "opt out" for physician supervision of nurse anesthetists." Retrieved November 20, 2008, from http://www.coruralhealth.org/crhc/resources/fact%20sheets/crna_fs_12.06.pdf.
- ¹⁸⁷ Brown, S., and D. Grimes. (1995). "A meta-analysis of nurse practitioners and nurse midwives in primary care." *Nursing Research* 44(8): 32-39.
- ¹⁸⁸ Horrocks, S., E. Anderson and C. Salisbury. (2002). "Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors." *British Medical Journal* 324 (2002): 819-823.
- ¹⁸⁹ Relevant studies include: Lenaway, et al.; Ohman-Strickland, et al. Munding, et al. (2000 and 2004); Litaker, et al.; Hamric, et al.; Laurant, et al.; Brown, et al.; Oakley, et al.; Simonson, et al.; and Pine, et al.
- ¹⁹⁰ Ibid.
- ¹⁹¹ Venning. "Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care."
- ¹⁹² Ibid.
- ¹⁹³ Litaker, D., et al. (2003). "Physician-nurse practitioner teams in chronic disease management: The impact on costs, clinical effectiveness and patients' perception of care." *Journal of Interprofessional Care* 17 (3): 223-234.
- ¹⁹⁴ Ibid.
- ¹⁹⁵ Oakley, D., et al. (1996). "Comparison of outcomes of maternity care by obstetricians and certified nurse midwives." *Outcomes of Care* 88(5): 823-29.
- ¹⁹⁶ Lenaway, D., et al. (1998). "Evaluation of a public-private certified nurse-midwife maternity program for indigent women." *American Journal of Public Health* 88(4):675-79.
- ¹⁹⁷ Grumbach, K., et al. (2003). "Who is caring for the underserved? A comparison of primary care physicians and nonphysician clinicians in California and Washington." *Annals of Family Medicine* 1(2): 97-104.
- ¹⁹⁸ Simonson, D., M. Ahern and M. Hendryx. (2007). "Anesthesia staffing and anesthetic complications during Cesarean delivery: A retrospective analysis." *Nursing Research* 56(1): 9-17.
- ¹⁹⁹ Monajem, S. (2006). "Integration of oral health into primary health care: The role of dental hygienists and the WHO stewardship." *International Journal of Dental Hygiene* 4: 47-51.
- ²⁰⁰ Maine Department of Professional and Financial Regulation, Board of Dental Examiners, Rule-making. Retrieved December 8, 2008, from <http://www.mainedental.org/forms/RuleMaking.pdf>.

-
- ²⁰¹ Dental Practice Law of Colorado (2007) 12-35-124 3a. December 29, 2008, from <http://www.dora.state.co.us/Dental/Statute.pdf>
- ²⁰² American Dental Association. Retrieved November 17, 2008, from http://www.ada.org/prof/ed/testing/jcnde_enewsletter_summer_08.pdf.
- ²⁰³ Champlain Valley Area Health Education Center. "Health careers spotlight: Dental hygienist." Retrieved November 17, 2008, from <http://www.cvahec.org/spotlights/dentalhygienist.htm>.
- ²⁰⁴ See Appendix # for the literature bibliography
- ²⁰⁵ Researchers were not able to recruit a comparison group of dental practices willing to participate. Therefore, a convenience sample of dental practices was identified wherein independent evaluators reviewed dental records provided by a governmental agency and private insurance company during the same period.
- ²⁰⁶ Evidence must exist in the record that there had been adequate follow-up based on affirmative answers to medical questions indicating that it was safe to proceed with dental care.
- ²⁰⁷ Frequency of radiographs was measured using the U.S. Food and Drug Administration criteria.
- ²⁰⁸ Schaffner, J., P. Ludwig-Beymer and J. Wiggins. (1995). "Utilization of advanced practice nurses in healthcare systems and multispecialty group practice." *Journal of Nursing Administration* 25(12).
- ²⁰⁹ Capan, P., M. Beard and M. Mashburn. (1993). "Nurse-managed clinics provide access and improved health care." *Nurse Practitioner* 18(5).
- ²¹⁰ Keith, A., A. Coburn and E. Mahoney. (1998). "Satisfaction with practice in a rural state: Perceptions of nurse practitioners and nurse midwives." *Journal of the American Academy of Nurse Practitioners* 10(1).
- ²¹¹ Keleher, K. (1998). "Characteristics, barriers, benefits and implications for midwifery." *Journal of Nurse-Midwifery* 43(1).
- ²¹² Keith A, Coburn A, and Mahoney E. (1998). "Satisfaction with Practice in a Rural State: Perceptions of Nurse Practitioners and Nurse Midwives." *Journal of the American Academy of Nurse Practitioners* 10(1)
- ²¹³ Schaffner. "Utilization of advanced practice nurses in healthcare systems and multispecialty group practice."
- ²¹⁴ Cawley, J. (1991). "Hospital physician assistants past, present and future." *Hospital Topics* 69 (3):14-19.
- ²¹⁵ Ibid.
- ²¹⁶ Ibid.
- ²¹⁷ U.S. Department of Health and Human Services, Health Resources and Services Administration. Retrieved November 25, 2008, from <http://granteefind.hrsa.gov/searchbyprogram.aspx?select=H2A&index=206>.
- ²¹⁸ Jones, M., and D. Clark. (1997). "Increasing access to health care: A study of pediatric nurse practitioner outcomes in a school-based clinic." *Journal of Nursing Care Quality* 11(4):53-59.
- ²¹⁹ Shi, L., et al. (1994). "A rural-urban comparative study of non-physician providers in Community and Migrant Health Centers." *Public Health Reports* 106(6).
- ²²⁰ Formicola, A., M. Ro and S. Marshall. (2004). "Strengthening the oral health safety net: Delivery models that improve access to oral health care for uninsured and underserved populations." *American Journal of Public Health* 94 (5):702-04.
- ²²¹ McKinnon, M., et al. (2007). "Emerging allied dental workforce models: Considerations for academic dental institutions." *Journal of Dental Education* 71(11): 1476-91.
- ²²² American Dental Hygiene Association. (2008). *Competencies for the Advanced Dental Hygiene Practitioner*. Retrieved December 19, 2008, from <http://www.adha.org/downloads/competencies.pdf>.
- ²²³ Minnesota Oral Health Practitioner. Retrieved October 8, 2008, from <http://www.health.state.mn.us/healthreform/legislation/sf2942.pdf>.
- ²²⁴ Gehshan, S., and M. Wyatt. (2007). *Improving Oral Health Care for Young Children*. National Academy for State Health Policy. Retrieved December 19, 2008, from http://www.nashp.org/Files/Improving_Oral_Health.pdf.
- ²²⁵ Byck, G., J. Cooksey and J. Russinof. (2005). "Safety-net dental clinics: A viable model for access to dental care." *Journal of the American Dental Association* 136:1013-21.
- ²²⁶ Felland, L., J. Lauer and P. Cunningham. (2008). *Community Efforts to Expand Dental Services for Low-income People*. Center for Studying Health System Change. Issue Brief No. 122. Retrieved December 19, 2008, from <http://www.hschange.com/CONTENT/1000/>.
- ²²⁷ Gehshan. *Improving Oral Health Care for Young Children*.
- ²²⁸ Centers for Medicare & Medicaid Services. "Chapter 12-Physicians/nonphysician practitioners." *Medicare Claims Processing Manual*. Retrieved November 24, 2008, from <http://www.cms.hhs.gov/manuals/downloads/clm104c12.pdf>.

²²⁹ Centers for Medicare & Medicaid Services. "Chapter 15-Covered medical and other health services." *Medicare Benefit Policy Manual*. Retrieved November 24, 2008, from <http://www.cms.hhs.gov/manuals/Downloads/bp102c15.pdf>.

²³⁰ PA reimbursement clarification provided by AAPA.

²³¹ Colorado Medical Assistance Program. "General provider information and requirements." Retrieved November 24, 2008, from

<http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type&blobheadervalue1=inline%3B+filename%3D988%2F195%2FGeneral+Provider+Information+100608.pdf&blobheadervalue2=abinary%3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1191402742411&ssbinary=true>.

²³² Colorado Medical Assistance Program. "Dental." Retrieved November 24, 2008, from

http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type&blobheadervalue1=inline%3B+filename%3D122%2F907%2F2006_ADA_Dental_Billing_Manual_092308.pdf&blobheadervalue2=abinary%3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1191402421792&ssbinary=true.

²³³ Colorado Medicaid Provider Services. (2002). *Medicaid Bulletin-Colorado Title XIX*. Retrieved November 24, 2008, from

<http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type&blobheadervalue1=inline%3B+filename%3D756%2F549%2FB0200125.pdf&blobheadervalue2=abinary%3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1191402373293&ssbinary=true>.

²³⁴ Information provided by Child Health Plan Plus (CHP+) representative.