

LITERATURE ON QUALITY OF NP PRACTICE

DISCUSSION PAPER

Since the nurse practitioner (NP) role was established in 1965, research has consistently demonstrated the excellent outcomes and high quality of care provided by NPs. The body of literature supports the position that NPs provide care that is effective, patient-centered, efficient, safe, and evidence-based. Furthermore, NP-delivered care is comparable in quality to physician care, demonstrated by numerous studies that make direct comparisons using a variety of measures.

This collection of research on the quality of NP care has five sections. First, systematic reviews and meta-analyses provide the strongest evidence of quality because they synthesize evidence from multiple studies. The next sections present single studies focused on different ways of measuring quality: patient-level health outcomes, patient utilization of care that reflects quality and NPs' care processes. The last section presents historical studies from 2010 or earlier. Several sections contain studies that are also included in the American Association of Nurse Practitioners® review of literature on NP cost-effectiveness because they examine both cost and quality outcomes. The list of studies in each section is ordered according to publication date starting with the most recent.

Section I. Systematic reviews and meta-analyses

Systematic reviews establish inclusion criteria based on rigor, critically evaluate the strength of individual studies and draw conclusions based on the evidence generated across those studies. Meta-analyses are statistical analyses of pooled data from multiple studies on the same topic. Some of the reviews in this bibliography include only U.S.-based studies and others include a combination of U.S. and international studies (denoted by an asterisk).

In general, systematic reviews have found that NP-led care improves patient health and is comparable in quality to physician care. This conclusion is well-supported by a recent systematic review of systematic reviews: Kilpatrick et al. (2023) examined 117 systematic reviews representing 1,653 original studies on advance practice nursing, including over 50 reviews with U.S.-based studies. They found consistent evidence that NP care is equal to or better than that of physicians in a range of settings. This finding is consistent with other reviews that have assessed a wide range of patient- and provider-level measures of NP care (Htay & Whitehead, 2021; Swan et al., 2015; Stanick-Hutt & Newhouse, 2013; Newhouse, 2011).

Other systematic reviews focus on specific types of care. Two recent reviews found that NP care was associated with decreases in depression and anxiety, among other positive mental health outcomes (Weissinger et al., 2024 and Turi et al., 2023). McMenamin et al. (2023) found that primary care from NPs resulted in improved or equal outcomes for patients with chronic conditions. Carranza et al. (2021) found that NPs perform as well as or better than physicians on multiple measures of specialty care quality. Two reviews showed that the quality of emergency and critical care provided by NPs was equal to or better than that of physicians across multiple measures (Jennings et al., 2015; Woo et al., 2017). Finally, one meta-analysis on cardiovascular care found no significant differences between NP-led care and usual care in readmissions, length of stay and health-related quality of life (Smigorsky et al., 2019).

1. Weissinger, G. M., Brom, H., Macneal, L., & Petoskey, C. (2024). Psychiatric Mental Health Nurse Practitioner Job and Patient Outcomes: A Scoping Review. *The Journal for Nurse Practitioners*, 20(6).

This scoping review assessed 24 studies on the job-related outcomes of psychiatric mental health nurse practitioners (PMHNPs) and the mental health outcomes of their patients. The review found that PMHNP-delivered care was associated with decreases in depression, anxiety and hospitalizations and increases in treatment adherence and patient satisfaction. Overall, the evidence suggests that PMHNP care is high-quality and has positive impacts on patients' mental health.

2. * Kilpatrick, K., Savard, I., Audet, L. A., Costanzo, G., Khan, M., Atallah, R., Jabbour, M., Zhou, W., Wheeler, K., Ladd, E., Gray, D. C., Henderson, C., Spies, L. A., McGrath, H., & Rogers, M. (2024). A global perspective of advanced practice nursing research: A review of systematic reviews. *PLOS One*, 19(7), e0305008.

Kilpatrick et al. conducted a systematic review of systematic reviews on NP-delivered care published between 2011 and 2023. The review found that NP care performed as well as or better than control groups. Additionally, NP care resulted in equal to significant reductions in hospitalizations, length of stay and emergency room (ER) visits across most reviews. Overall, no outcomes consistently favored non-NP care, and the majority of reviews found NP care produced outcomes equal to or better than those of the control groups.

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3. Turi, E., McMenamin, A., Kueakomoldej, S., Kurtzman, E., & Poghosyan, L. (2023). The effectiveness of nurse practitioner care for patients with mental health conditions in primary care settings: A systematic review. *Nursing Outlook*, 71(4), 101995.

This review synthesized available evidence on the effectiveness of NP-delivered primary care for patients with mental health conditions from 2014 to 2022. The authors critically evaluated 17 studies. The strongest studies showed that NP care processes, including prescribing, were generally similar to those of physicians. Other studies found clinically or statistically significant positive effects on patients' mental health outcomes.

4. McMenamin, A., Turi, E., Schlak, A., & Poghosyan, L. (2023). A Systematic Review of Outcomes Related to Nurse Practitioner-Delivered Primary Care for Multiple Chronic Conditions. *Medical Care Research and Review*, 80(6), 563-581.

McMenamin et al. reviewed the roles and effects of NPs on primary care patients with chronic conditions, examining cost, quality and utilization in 15 studies published between 2003-2021. Several studies found either modest improvements in patient outcomes after patients received NP care, such as diabetes and blood pressure outcomes, or found no difference from their previous care plans. Additionally, NP care was associated with improved patient empowerment, confidence and self-management.

5. * Carranza, A. N., Munoz, P. J., & Nash, A. J. (2021). Comparing quality of care in medical specialties between nurse practitioners and physicians. *Journal of the American Association of Nurse Practitioners*, 33(3), 184-193.

This study reviewed 11 U.S. and international studies on patient outcomes between NPs and physicians in specialty outpatient settings between 1995 and 2016. Published research consistently demonstrated NPs performed as well as physicians in patient safety, quality of life, treatment complications, symptom management and adverse effects. Furthermore, multiple studies found better mortality rates, disease progression, treatment adherence, treatment success and patient satisfaction in patients treated by NPs, compared to physicians.

6. * Htay, M., & Whitehead, D. (2021). The effectiveness of the role of advanced nurse practitioners compared to physician-led or usual care: A systematic review. *International Journal of Nursing Studies Advances*, 3, 100034.

Htay and Whitehead evaluated 13 randomized controlled trials conducted from 2000 to 2019 that addressed the role of NPs in health care and how NPs address complex patient care. The review showed strong quality of care by NPs, including adherence to guidelines, medication costs and requirements, health status, patient satisfaction, time spent in clinics and physical functioning.

7. * Smigorsky, M. J., Sebastianski, M., Sean McMurtry, M., Tsuyuki, R. T., & Norris, C. M. (2020). Outcomes of nurse practitioner-led care in patients with cardiovascular disease: A systematic review and meta-analysis. *Journal of Advanced Nursing*, 76(1), 81-95.

Smigorsky et al. conducted a systematic review and meta-analysis to evaluate literature published between 2007 and 2017 on the effectiveness of NP-led cardiovascular care. Meta-analytic results combining data from five studies showed no statistical differences between readmission for heart failure, length of stay and health-related quality of life between NP-led care and previous care.

8. * Woo, B. F. Y., Lee, J. X. Y., & Tam, W. W. S. (2017). The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: A systematic review. *Human Resources for Health*, 15, 1-63.

The authors reviewed 15 studies on the impact of advanced practice nursing on the quality of care, clinical outcomes, patient satisfaction and cost in emergency and critical care settings between 2006 and 2016. The review found that NPs provided equal or better quality of care in terms of time-to-consultation, treatment, patient satisfaction and length of stay, as compared to usual service models. Additionally, NPs had equal patient mortality compared to that of physicians.

9. * Jennings, N., Clifford, S., Fox, A. R., O'Connell, J., & Gardner, G. (2015). The impact of nurse practitioner services on cost, quality of care, satisfaction and waiting times in the emergency department: a systematic review. *International Journal of Nursing Studies*, 52(1), 421-435.

This systematic review synthesized 14 papers published between 2006 and 2014 on the impact of emergency nurse practitioners on cost, quality of care, satisfaction and waiting times in emergency departments (EDs). NPs' quality of care was equal to or higher than that of doctors or medical provider groups. Additionally, patients managed

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by ED NPs had shorter wait times for care, ranging from 7-28 minutes less across nine studies, compared to patients managed by ED physicians.

10.* Swan, M., Ferguson, S., Chang, A., Larson, E., & Smaldone, A. (2015). Quality of primary care by advanced practice nurses: a systematic review. *International Journal for Quality in Health Care*, 27(5), 396-404.

Swan et al. conducted a systematic review of randomized control trials to assess the safety and effectiveness of primary care by NPs. Of the 10 studies that met inclusion criteria, two showed patients seen by NPs had better cholesterol and diastolic blood pressure, four found higher patient satisfaction among NPs, two found lower cost of care and three showed longer patient consultation times with NPs compared to physicians.

11. Stanik-Hutt, J., Newhouse, R., (2013). The quality and effectiveness of care provided by Nurse Practitioners. *The Journal for Nurse Practitioners*, 9(8).

Study authors systematically reviewed evidence regarding the impact of NPs compared to medical doctors (MDs) on health care quality, safety and effectiveness. Data from 37 articles published from 1990 to 2009 were summarized into 11 aggregated outcomes. Outcomes for NPs are comparable or better for all 11 outcomes reviewed. A high level of evidence indicated better serum lipid levels in patients cared for by NPs in primary care settings. A high level of evidence also indicated that patient outcomes on satisfaction with care, health status, functional status, the number of ED visits and hospitalizations, blood glucose, blood pressure and mortality were similar for NPs and MDs.

12. Newhouse, R. P., Stanik-Hutt, J., White, K. M., Johantgen, M., Bass, E. B., Zangaro, G., Wilson, R. F., Fountain, L., Steinwachs, D. M., Heindel, L., & Weiner, J. P. (2011). Advanced practice nurse outcomes 1999-2008: A systematic review. *Nursing Economics*, 29(5), 1-22.

The outcomes of NP-delivered care were examined through a systematic review of 37 published studies, most of which compared NPs' outcomes with those of physicians. Outcomes included measures such as patient satisfaction; patient perceived health status; functional status; hospitalizations; ED visits; and biomarkers such as blood glucose, serum lipids and blood pressure. Newhouse et al. concluded that NPs' patient outcomes are comparable to those of physicians.

Section II. Health outcomes

Health outcomes measure the results of care delivered by different providers and are therefore arguably the most important way to assess quality. Research on the outcomes of NP care has consistently found that NPs provide safe and high-quality care for a range of conditions across diverse health care settings (including private practices, hospitals and nursing homes) and patient populations (including Veterans Health Administration [VHA], Medicare and Medicaid enrollees).

A substantial number of studies have compared the quality of diabetes care provided by NPs and physicians, finding no statistically significant differences in outcomes like hemoglobin A1C, or only clinically insignificant differences (Harrison et al., 2023; Schuttner et al., 2023; Liu et al., 2020; Everett et al., 2020; Yang et al., 2018; Jackson et al., 2018; Lutfiyya, 2017; Virani et al., 2016; Everett et al., 2013). Studies have likewise found comparable outcomes for controlled blood pressure (Liu, 2020; Wright, 2011) and cholesterol (Harrison et al., 2023; Liu, 2020). Research on outcomes of acute care has found equal or lower risk of mortality following from NP care compared to care from other providers (Landsperger et al., 2016; Tapper et al., 2020). Finally, a study of nursing home care found overall better outcomes for patients in nursing homes with advanced practice registered nurses (Rantz et al., 2018).

1. Harrison, J. M., Kranz, A. M., Chen, A. Y. A., Liu, H. H., Martsolf, G. R., Cohen, C. C., & Dworsky, M. (2023). The impact of nurse practitioner-led primary care on quality and cost for Medicaid-enrolled patients in states with pay parity. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 60.

Harrison et al. analyzed 2012-2013 Medicaid claims data for adults with diabetes and children with asthma. The authors used entropy balancing and instrumental variable estimates with linear regression to examine the effects of NPs and physician care on patient outcomes. In 14 states with pay parity for fee-for-service Medicaid, patients with diabetes who were attributed to NPs had no differences in hemoglobin A1C, LDL, cholesterol or medical attention for nephropathy compared to patients attributed to physicians. In a sub-analysis limited to full practice authority (FPA) states, patients had slightly better diabetes quality of care outcomes than those in non-FPA states. Findings on the quality of NP care for children with asthma were mixed, although estimates varied depending on the authors' modeling approach.

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2. Schuttner, L., Richardson, C., Parikh, T., & Wong, E. S. (2023). "Low-value" glycemic outcomes among older adults with diabetes cared for by primary care nurse practitioners or physicians: A retrospective cohort study. *International Journal of Nursing Studies*, 104532.

Schuttner et al. used a retrospective cohort design to examine diabetes outcomes and glycemic overtreatment for patients at risk of hypoglycemia who were assigned to NPs or physicians. The authors analyzed national U.S. Department of Veterans Affairs (VA) data from 2010 to 2012 (N=38,543). Patients assigned to NPs were 20% less likely to have hemoglobin A1C levels of less than seven two years later, compared to patients assigned to physicians. This finding suggests that NPs manage high-risk patients with diabetes as well as or better than physicians.

3. Liu, C. F., Hebert, P. L., Douglas, J. H., Neely, E. L., Sulc, C. A., Reddy, A., & Wong, E. S. (2020). Outcomes of primary care delivery by nurse practitioners: Utilization, cost, and quality of care. *Health Services Research*, 55(2), 178-189.

Liu et al. examined differences in utilization, cost and clinical outcomes between NP-assigned patients and MD-assigned patients using 2010-2012 VA administrative data for 806,434 patients from 530 VA facilities. Using a difference-in-differences approach, Liu et al. found no statistically significant differences in control of hemoglobin A1C, cholesterol or blood pressure. They also found that patients assigned to NPs were less likely to utilize primary care, specialty care and inpatient services and had no difference in costs.

4. Tapper, E. B., Hao, S., Lin, M., Mafi, J. N., McCurdy, H., Parikh, N. D., & Lok, A. S. (2020). The quality and outcomes of care provided to patients with cirrhosis by advanced practice providers. *Hepatology*, 71(1), 225-234.

Tapper et al. examined the effect of care quality and outcomes for adult cirrhosis patients managed by advanced practice providers (APPs [NPs and PAs]). The authors conducted a retrospective analysis using Optum, an American commercial claims database, which yielded 389,257 unique patients. Noting that hepatocellular carcinoma screening is underused for patients with cirrhosis, the authors found that patients of APPs had strongly improved screening rates. They found modestly improved rates of varices screening. Patients of APPs also had increased use of rifaximin after discharge for hepatic encephalopathy, lower risk of readmission within 30 days and lower risk of death. When working with gastroenterologists/hepatologists, APPs were associated with improved quality of care and patient outcomes.

5. Everett, C. M., Morgan, P., Smith, V. A., Woolson, S., Edelman, D., Hendrix C. C., Berkowitz, T., White, B., & Jackson, G. L. (2019). Primary Care provider type: Are there differences in patients' intermediate diabetes outcomes? *Journal of the American Academy of Physician Assistants*, 32(6), 36-42.

Using electronic health record data from the Veterans Health Administration (VHA), Everett et al. examined differences in diabetes outcomes among 609,668 patients being treated at primary care clinics by physicians, PAs and NPs serving in both primary care provider (PCP) and supplemental provider roles. Outcomes were examined for patients who experienced care provided by MD PCPs, PA PCPs, NP PCPs or combinations of PCPs with supplemental providers. Everett et al. found no clinically significant differences in intermediate diabetes outcomes (e.g., A1C, Systolic BP, LDL-C) between provider types, regardless of their role as usual PCP or supplemental providers.

6. Kippenbrock, T., Emory, J., Lee, P., Odell, E., Buron, B., & Morrison, B. (2019). A national survey of nurse practitioners' patient satisfaction outcomes. *Nursing Outlook*, 67(6), 707-712.

To expand upon previous studies conducted that examine patient satisfaction among NPs and MDs, Kippenbrock et al. analyzed responses from the Consumer Assessment of Healthcare Providers and Systems survey (n=53,885), which included several provider types: NP, MD, doctor of osteopathy and PA. The authors found that patient satisfaction was higher for NPs than other provider types.

7. Jackson, G. L., Smith, V. A., Edelman, D., Woolson, S. L., Hendrix, C. C., Everett, C. M., Berkowitz, T. S., White, B. S., & Morgan, P. A. (2018). Intermediate diabetes outcomes in patients managed by physicians, nurse practitioners, or physician assistants: A cohort study. *Annals of Internal Medicine*, 169(12), 825-835.

Jackson et al. examined whether any differences existed in intermediate diabetes patient outcomes between physicians, NPs or PAs within a primary care setting. The authors conducted a cohort study using administrative data from the VA electronic health record. The sample included 368,481 patients from 568 VA primary care facilities. Jackson et al. did not find any significant differences in diabetes outcomes across provider groups, providing further evidence that NPs, PAs and MDs provide comparable care.

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8. Rantz, M. J., Popejoy, L., Vogelsmeier, A., Galambos, C., Alexander, G., Flesner, M., & Petroski, G. (2018). Impact of advanced practice registered nurses on quality measures: The Missouri quality initiative experience. *Journal of the American Medical Directors Association*, 19(6), 541-550.

To examine the impact of advanced practice registered nurses (APRNs) on quality measure scores within the Missouri Quality Initiative intervention, Rantz et al. conducted a two-group comparison analysis, in which a matched group was selected from facilities within the same county as the intervention nursing homes that were similar in quality measure scores, size and ownership between September 2013 and September 2016. Rantz et al. found that quality measure scores for the APRN intervention group were better than the comparison group.

9. Yang, Y., Long, Q., Jackson, S. L., Rhee, M. K., Tomolo, A., Olson, D., & Phillips, L. S. (2018). Nurse practitioners, physician assistants, and physicians are comparable in managing the first five years of diabetes. *The American Journal of Medicine*, 131(3), 276-283.

Yang et al. examined hemoglobin A1C levels in VA patients cared for by NPs, PAs and physicians, all of whom were responsible for similar patient panels within this integrated health care system during the years of the study. A retrospective cohort study focused on veterans who had been newly diagnosed with diabetes in 2008, experienced the continuation of primary care between 2008 and 2012 and had 75% or greater percentage of primary care visits with one of the three provider types. Outcomes of diabetes management by NPs and PAs were comparable to those of physicians during the four-year follow-up period.

10. Lutfiyya, M. L., Tomai, L., Frogner, B., Cerra, F., Zismer, D., & Parente, S. (2017). Does primary care diabetes management provided to Medicare patients differ between primary care physicians and nurse practitioners? *Journal of Advanced Nursing*, 73(1), 240-252.

Lutfiyya et al. examined whether Medicare patients who received primary care Type 2 diabetes (DM2) management differed in scope and outcomes by provider type. The authors conducted a cross-sectional quantitative analysis of 2012 U.S. Medicare National Claims History, also known as the 5% Standard Analytic File. For patient comparison, they used a medical productivity index to stratify Medicare DM2 patients. Diabetes management by NPs was associated with lower cost and better quality of care compared to management by physicians.

11. Landsperger, J. S., Semler, M. W., Wang, L., Byrne, D. W., & Wheeler, A. P. (2016). Outcomes of nurse practitioner-developed critical care: A prospective cohort study. *Chest*, 149(5), 1146-1154.

Landsperger et al. conducted a prospective cohort study of adult medical intensive care unit (ICU) admissions at an academic tertiary care center between 2011 and 2013. The authors compared 90-day survival rates between care administered to patients by acute care nurse practitioners (ACNPs) and resident teams using Cox proportional hazards regression. Among the 9,066 admissions the study addressed, patients cared for by ACNPs had lower ICU mortality rates and shorter lengths of hospital stays. Hospital mortality and ICU length of stay was similar between the two providers.

12. Virani, S. S., Akeroyd, J. M., Ramsey, D. J., Chan, W. J., Frazier, L., Nasir, K., & Petersen, L. A. (2016). Comparative effectiveness of outpatient cardiovascular disease and diabetes care delivery between advanced practice providers and physician providers in primary care: Implications for care under the Affordable Care Act. *American Heart Journal*, 181, 74-82.

Virani et al. compared the quality of care for diabetes and cardiovascular disease (CVD) by APPs and physicians in a primary care setting. The authors used clinical and administrative data to identify diabetes or CVD patients who sought care from all 130 VA facilities during the 2014 fiscal year (October 2013–September 2014). The quality of care for diabetes and CVD patients was comparable between APPs and physicians; there were minor but clinically insignificant differences for various outcomes.

13. Everett, C., Thorpe, C., Palta, M., Carayon, P., Bartels, C., & Smith, M. A. (2013). Physician assistants and nurse practitioners perform effective roles on teams caring for Medicare patients with diabetes. *Health Affairs (Project Hope)*, 32(11).

To improve the delivery of care, patient-centered medical homes often rely on a team of clinicians with common goals and defined roles. Everett et al. examined Medicare data from a large physician group to compare the outcomes of two groups of adult Medicare patients with diabetes at various levels of complexity who received primary care from PA and NP teams and physician-only teams. The authors found that most supplemental care by PAs and NPs was comparable or better than physician-only care.

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14. Wright, W. L., Romboli, J. E., DiJulio, M. A., Wogen, J., & Belletti, D. A. (2011). Hypertension treatment and control within an independent nurse practitioner setting. *American Journal of Managed Care*, 17(1), 58-65.

To compare the proportion of hypertensive patients with controlled blood pressure treated by NPs vs. MD PCPs, Wright et al. conducted a cross-sectional retrospective medical record review at 21 physician-based practices across the U.S. and three independent NP-based practices in the northeastern U.S. between December 2007 and November 2009. Wright et al. found comparable controlled blood pressure rates across provider groups.

Section III. Utilization

Another body of research examines NP quality of care through the lens of health care utilization. Utilization of low-value, high-cost services — such as avoidable hospital visits, readmissions, ED services or low-value imaging and testing — is affected by the quality of primary care that patients receive from NPs or other providers. When patients receive high-quality primary care, their needs are better managed, and they use less low-value care. Higher utilization of preferred or high-value care — such as hospice care or high prescription adherence — likewise reflects high-quality NP care.

Studies that examine utilization of low-value care have consistently found that NP patients use fewer high-cost, high-intensity services like hospital and ED visits compared to patients of physicians (Kosar et al., 2024; Yang et al., 2023; Smith et al., 2020; Muench et al., 2019; Buerhaus et al., 2018; DesRoches et al., 2017; Kuo et al., 2015). Another study found that patients of NPs and physicians used equivalent levels of low-value antibiotics and imaging services (Mafi et al., 2016). Studies that assess utilization of high value care have found that NPs' patients have higher hospice rates (Kosar et al., 2024) and rates of preferred medication adherence (Muench et al., 2019).

1. Kosar, C. M., Thapa, B. B., Muench, U., Santostefano, C., Gadbois, E. A., Oh, H., Gozalo, P. L., Rahman, M., & White, E. M. (2024, May). Nurse Practitioner Care, Scope of Practice, and End-of-Life Outcomes for Nursing Home Residents With Dementia. *JAMA Health Forum*, 5(5), e240825-e240825. American Medical Association.

This study used the 2015 to 2018 Medicare enrollment and claims data to examine end of life outcomes for nursing home patients with Alzheimer's disease and related dementia. The authors categorized NP involvement in care as minimal (<10%), moderate (10-50%) or extensive (>50%), and analyzed outcomes using linear regression. Results showed hospitalization rates were lower for patients who had moderate and extensive NP care compared with minimal NP care, and hospice use (a high-value care type) was higher for moderate and extensive NP care compared to minimal NP care.

2. Yang, B. K., Idzik, S., Nelson, H. W., & McSweeney-Feld, M. H. (2023). Nurse practitioner employment in relation to nursing staff turnover and resident care outcomes in U.S. nursing homes. *Journal of the American Medical Directors Association*.

Yang et al. analyzed payroll and claims data from 2021-2022 for 13,966 nursing homes. They applied "doubly robust" inverse probability weighting and regressions to identify the impact of NPs on staff turnover, hospital utilization, infection control and patient satisfaction. Nursing homes that employed NPs had fewer hospitalizations per 1,000 resident days among long-stay residents. Nursing homes that employed NPs who worked at least 20 hours per week also had fewer ED visits among long-stay residents. Nursing homes with NPs also had lower registered nurse and certified nursing assistant turnover rates, fewer infection control citations and fewer complaints than nursing homes without NPs.

3. Smith, V. A., Morgan, P. A., Edelman, D., Woolson, S. L., Berkowitz, T. S. Z., Van Houtven, C. H., Hendrix, C. C., Everett, C. M., White, B. S., & Jackson, G. L. (2020). Utilization and costs by primary care provider type: Are there differences among diabetic patients of physicians, NPs, and PAs? *Medical Care*, 58(8), 681.

Smith et al. examined diabetic outcomes and cost savings using VA data from 2012 (N=279,009). Primary care patients of NPs had lower odds of ED use compared to patients of physicians. Additionally, NP patients had significantly lower inpatient, outpatient and pharmacy costs, resulting in substantially lower costs for patients who saw NPs. NPs provide care that results in patients needing fewer hospital visits and saves patients and hospitals money.

4. Muench, U., Guo, C., Thomas, C., & Perloff, J. (2019). Medication adherence, costs, and ER visits of nurse practitioner and primary care physician patients: evidence from three cohorts of Medicare beneficiaries. *Health Services Research*, 54(1), 187-197.

Muench et al. used weighted propensity score matching combined with logistic regression to examine differences in good medication adherence; office-based and specialty care costs; and ER visits between patients seen by

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NPs and those seen by MD PCPs; using Medicare Part A, B and D claims between 2009 and 2013. The three drug class cohorts for analysis consisted of anti-diabetics, renin-angiotensin system antagonists (RASA) and statins. Muench et al. found no differences in good medication adherence for anti-diabetics or RASA between NP and MD PCPs. Across all three medications, beneficiaries seeing NPs experienced lower office-based and specialty care costs and ER visits.

5. Buerhaus, P., Perloff, J., Clarke, S., O'Reilly-Jacob, M., Zolotusky, G., & DesRoches, C. M. (2018). Quality of primary care provided to Medicare beneficiaries by nurse practitioners and physicians. *Medical Care*, 56(6), 484-490.

Buerhaus et al. examined the quality of care provided by primary care nurse practitioners (NP PCPs), primary care physicians (MD PCPs) or both types of clinicians using 2012 and 2013 Medicare part A and part B claims. The authors used a retrospective cohort design with standard risk-adjustment methodologies and propensity score weighting to assess 16 claims-based quality measures, which were grouped into several primary care domains: chronic disease management, preventable hospitalizations, adverse outcomes and cancer screening. The authors found that beneficiaries treated by NP PCPs had lower rates of hospital admissions, readmissions and inappropriate ED use, as well as low-value imaging, compared to beneficiaries treated by PCMDs or jointly attributed clinicians.

6. DesRoches, C. M., Clarke, S., Perloff, J., O'Reilly-Jacob, M., & Buerhaus, P. (2017). The quality of primary care provided by nurse practitioners to vulnerable Medicare beneficiaries. *Nursing Outlook*, 65(6), 679-688.

To compare quality indicators of Medicare beneficiaries managed by PCNPs and PCMDs, DesRoches, et al. used a retrospective cohort design that examined 2012 and 2013 Medicare claims for three subpopulations among beneficiaries: qualifying due to disability; dually eligible for both Medicare and Medicaid; and disabled and eligible for both programs. Overall, the authors found that beneficiaries managed by PCNPs has a lower risk of preventable hospitalizations and a reduced use of ER services and other health care resources.

7. Mafi, J. N., Wee, C. C., Davis, R. B., & Landon, B. E. (2016). Comparing use of low-value health care services among U.S. advanced practice clinicians and physicians. *Annals of Internal Medicine*, 165(4), 237-244.

The authors used National Ambulatory Medical Care Survey (NAMCS) data and National Hospital Ambulatory Medical Care Survey (NHAMCS) data from 1997 to 2011 to compare the use of low-value services in both primary care and ambulatory hospital settings: guideline-discordant antibiotics for upper respiratory infections; radiography for back pain; imaging for headache; and referrals for all three conditions. The authors found that APPs and physicians provided equivalent low-value services.

8. Kuo, Y., Chen, N., Baillargeon, J., Raji, M. A., & Goodwin, J. S. (2015). Potentially preventable hospitalizations in Medicare patients with diabetes: A comparison of primary care provided by nurse practitioners versus physicians. *Medical Care*, 53(9), 776-783.

The authors compared rates of potentially preventable hospitalizations of Medicare beneficiaries with a diagnosis of diabetes for patients of NPs and physicians. Patients with a diagnosis of diabetes between 2007 and 2010 (n=345,819) who received all primary care from an NP only or a physician only were selected from a sample of Medicare beneficiaries. The NP cohort and physician cohort were selected from national Medicare data using diabetes indicator data from the CMS Chronic Disease Data Warehouse, while additional data were captured by administrative claims. Several statistical methods demonstrated that receipt of care from NPs was associated with a decreased risk of potentially preventable hospitalizations when compared to receipt of care from physicians.

Section IV. Care processes

Studies on care processes compare clinical decision making and care delivery by NPs and other providers. Recent research focuses on prescribing patterns, finding that chronic pain patients of NPs are less likely to receive opioid prescriptions than patients of physicians (Nikpour, 2022), that performance on prescribing quality measures is comparable between NPs and physicians (Jiao et al., 2018) and that NPs are less or equally likely to prescribe potentially inappropriate medications for older adults compared to physicians (Huynh et al., 2023; Tzeng et al., 2022; Chou et al., 2021).

Other research on care processes finds that NPs typically deliver comparable care to that of physicians, although NPs tend to provide more health education to patients (Kurtzman & Barnow, 2017; Ritsema et al., 2014) and more smoking cessation screening and counseling (Kurtzman & Barnow, 2017; Virani et al., 2015). A study on care provided in nursing homes

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found that care provided by NPs and physicians was similar, but that NPs had higher completion rates of advance directives (Melillo et al., 2015).

1. Huynh, J., Alim, S. A., Chan, D. C., & Studdert, D. M. (2023). Inappropriate Prescribing to Older Patients by Nurse Practitioners and Primary Care Physicians. *Annals for Internal Medicine*, 176(11):1448-1445.

Huynh and colleagues examine 2013-2019 Medicare part D claims for 23,699 NPs and 50,060 primary care physicians who wrote prescriptions for 100 or more patients per year in 29 states where NPs had prescriptive authority. They compared rates of inappropriate prescriptions for older patients, defined according to the Beers Criteria developed by the American Geriatrics Society. The authors found that rates of inappropriate prescribing by NPs and primary care physicians were the same. They also found that there were relatively high proportions of NPs among clinicians with the highest and lowest rates of inappropriate prescribing.

2. Nikpour, J., Broome, M., Silva, S., & Allen, K. D. (2022). Influence of Primary Care Provider Type on Chronic Pain Management Among Veterans. *Journal of Nursing Regulation*, 13(1).

Nikpour and colleagues compared prescribing patterns of physicians, NPs and PAs for chronic pain patients at VHA centers to assess whether concerns of NP opioid prescribing are justified. They examined patient medical records from October 2015 to September 2016 for 39,936 patients. The authors found that NP patients had lower odds of receiving opioid and non-opioid prescriptions vs. physician patients. There were no differences in high daily morphine equivalent dose or long-term opioid therapy by provider type.

3. Tzeng, H., Raji, M. A., Chou, L., & Kuo, Y. (2022). Impact of State Nurse Practitioner Regulations on Potentially Inappropriate Medication Prescribing Between Physicians and Nurse Practitioners. *Journal of Nursing Care Quality*, 37(1), 6-13.

Tzeng et al. examined potentially inappropriate medication (PIM) prescribing by NPs and physicians across states with varied NP scope of practice regulations, using Medicare data from 2015 to 2018. They defined PIM according to the Beers criteria defined by the American Geriatrics Society. The authors found lower PIM rates for initial and refill prescriptions from NPs than from physicians, and lower overall rates in states with FPA. The differences in PIM prescribing between NPs and physicians were similar across states with different NP practice regulations.

4. Chou, L., Kuo, Y., Raji, M. A., & Goodwin, J. S. (2021). Potentially inappropriate medication prescribing by nurse practitioners and physicians. *Journal of the American Geriatrics Society* (2021), 1-9.

Chou and colleagues looked at Texas Medicare data from 2016, assessing initial and refill PIM prescription rates for older adults according to the Beers criteria. They found that a visit to an NP was less likely to result in an initial or refill PIM compared to a visit to a physician. They also found that the relationship between reduced likelihood of an initial PIM and an NP visit was stronger for Black patients than white patients, and that the relationship between reduced likelihood of a refill PIM and an NP visit was stronger for older patients and those with more comorbidities.

5. Jiao, S., Murimi, I. B., Stafford, R. S., Mojtabai, R., & Alexander, G. C. (2018). Quality of prescribing by physicians, nurse practitioners, and physician assistants in the United States. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 38(4), 417-427.

To compare the quality of prescribing practices between physicians and NPs, the authors used serial cross-sectional analysis to examine data on 8.33 billion ambulatory patient visits in National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey data from 2006-2012. There were no differences in 10 out of 13 validated quality indicators focused on prescribing practices between NPs and physicians, across clinical practice settings. Of the other three prescribing practices, there was no consistent pattern: NPs and PAs had two significantly better prescribing practices and physicians had one significantly better (but not clinically relevant) prescribing practice. NPs' prescribing practices across specialties are comparable to those of physicians.

6. Kurtzman, E. T., & Barnow, V. S. (2017). A comparison of nurse practitioners, physician assistants, and primary care physicians' patterns of practice and quality of care in health centers. *Medical Care*, 55(6), 615-622.

The authors compared the quality of care and practice patterns of NPs, PAs and MD primary care providers in community health centers (CHCs) using data from the National Ambulatory Medical Care Survey (2006-2011). The study analyzed 23,704 patient visits to 1,139 practitioners within CHCs, and examined nine patient-level outcomes, such as smoking cessation, depression treatment, statin for hyperlipidemia and imaging services. Findings suggested

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that NPs were more likely to provide recommended smoking cessation counseling and more health education, as compared to MDs; however, no significant differences were found in any other measures of care across provider groups.

7. Melillo, K. D., Remington, R., Lee, A. J., Abdallah, L., Van Etten, D., Gautam, R., & Gore, R. (2015). Comparison of nurse practitioner and physician practice models in nursing facilities. *Annals of Long-Term Care*, 23(12), 19-24.

Melillo et al. investigated the differences in NP and physician practice models in long-term care (LTC) nursing facilities using data from the Medicare Current Beneficiary Survey for the years 2006–2010. The reported health status of patients did not differ between patients who received primary care from NPs and from physicians; however, the cohort with NP involvement had higher completion rates of advance directives than the physician-only cohort. The authors suggested that “By having a higher completion rate of do not resuscitate [DNR] orders, the inclusion of NPs in LTC nursing facility care teams potentially increases resident quality of life and reduces the cost of care by minimizing the use of costly, unwanted treatments.” Overall, NPs provided comparable care to that of MDs in LTC facilities.

8. Virani, S. S., Maddox, T. M., Chan, P. S., Tang, F., Akeroyd, J. M., Risch, S. A., & Petersen, L. A. (2015). Provider type and quality of outpatient cardiovascular disease care: insights from the NCDR PINNACLE registry. *Journal of the American College of Cardiology*, 66(16), 1803-1812.

Using patient data from the American College of Cardiology’s PINNACLE (Practice Innovation and Clinical Excellence) registry for patients who had an outpatient cardiology visit in 2012, the authors compared: 1) patients receiving care from APPs to patients receiving care from physicians in a practice with physicians and APPs, and 2) patients receiving care in practices with physicians and APPs to patients receiving care from physician-only practices. Performance measures included quality of care for coronary artery disease, heart failure and atrial fibrillation. Quality measures were comparable among both groups, and smoking cessation screening for coronary artery disease patients was higher for the APP group.

9. Ritsema, T. S., Bingenheimer, J. B., Scholting, P., & Cawley, J. F. (2014). Differences in the delivery of health education to patients with chronic disease by provider type, 2005-2009. *Preventing Chronic Disease*, (11)33.

This Centers for Disease Control and Prevention (CDC) research evaluated the rate of health education provided to patients with chronic diseases by NPs and certified midwives, PAs and physicians. The authors conducted a secondary analysis using a sample of 136,432 adult patient visits (2005–2009) with chronic conditions (asthma, chronic obstructive pulmonary disease [COPD], depression, diabetes, hyperlipidemia, hypertension, ischemic heart disease and obesity) drawn from the National Hospital Ambulatory Medical Care Survey (NHAMCS). They found that health education delivery to patients with chronic conditions was higher among NPs and PAs than physicians.

Section V. Historical studies

This section includes a select listing of systematic reviews, meta-analyses, single studies of various quality outcomes and selected government reports from 2010 or earlier. Collectively, these studies demonstrate that NPs have consistently delivered high-quality care since the creation of the NP role. Asterisks denote reviews or meta-analyses that include international studies.

1.* Naylor, M. D., & Kurtzman, E. T. (2010). The role of nurse practitioners in reinventing primary care. *Health Affairs*, 29(5), 893-99.

This meta-analysis of studies comparing the quality of primary care services of physicians and NPs demonstrates the role NPs play in reinventing how primary care is delivered. The authors found that comparable outcomes are obtained by both providers, with NPs performing better in terms of time spent consulting with the patient, patient follow-ups and patient satisfaction.

2. Borgmeyer, A., Gyr, P. M., Jamerson, P.A., & Henry, L.D. (2008). Evaluation of the role of the pediatric nurse practitioner in an inpatient asthma program. *Journal of Pediatric Health Care*, 22(5), 273-281.

Borgmeyer et al. evaluated the perception of pediatric nurse practitioners (PNPs) as a direct patient care manager and the pediatric patient outcomes (e.g., length of stay [LOS], cost, readmission rates) between Asthma Intervention Model (AIM) PNP-managed patients, intern-managed patients and peer children’s hospitals. Physicians, nurses, pediatric interns and families were surveyed about their experiences between July 1, 2003, and July 30, 2004. The authors concluded that PNPs were effective educators and managed patients appropriately. A comparison of AIM

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PNP-managed patients and intern-managed patients showed no significant difference in LOS or cost. None of the patients in either group experienced readmission.

3. Ohman-Strickland, P. A., Orzano, A. J., Hudson, S. V., Solberg, L. I., DiCiccio-Bloom, B., O'Malley, D., Tallia A. F., Balasubrsmanian, B. A., Crabtree, B. F. (2008). Quality of diabetes care in family medicine practices: Influence of nurse practitioners and physician's assistants. *Annals of Family Medicine*, 6(1), 14-22.

This study evaluated whether the quality of diabetes care differs between physician-only practices and practices with NPs or PAs and sought to identify any contributing characteristics related to differences in care. The authors conducted a cross-sectional analysis of baseline data of adult patients treated for Type 1 or Type 2 diabetes in the past year from 46 practices, measuring adherence to American Diabetes Association clinical guidelines. Family medicine practices with NPs performed better than physician-only practices and significantly better than practices with PAs regarding quality measures of diabetic care (e.g., monitoring hemoglobin A1C, lipid and microalbumin levels). Practices with NPs were also more likely to have patients attain lipid targets than practices with PAs.

4. Bakerjian, D. (2008). Care of nursing home residents by advanced practice nurses: A review of the literature. *Research in Gerontological Nursing*, 1(3), 177-185.

Bakerjian conducted an extensive literature review and found that long-term care patients managed by NPs were less likely to have avoidable geriatric complications, such as falls, urinary tract infections (UTIs), pressure ulcers, etc. than patients managed by primary care physicians. They also had improved functional status and better-managed chronic conditions.

5. Carter, A., & Chochinov, A. (2007). A systematic review of the impact of nurse practitioners on cost, quality of care, satisfaction and wait times in the emergency department. *Canadian Journal of Emergency Medicine*, 9(4), 286-95.

This systematic review of 36 articles examined whether the hiring of NPs in ERs can reduce wait time, improve patient satisfaction and result in the delivery of cost-effective, quality care. Results showed that hiring NPs can result in reduced wait times, leading to higher patient satisfaction. NPs were found to be equally as competent as physicians at interpreting X-rays and more competent at following up with patients by phone, conducting physical examinations and issuing appropriate referrals.

6. Laurant, M., Reeves, D., Hermens, R., Braspenning, J., Grol, R., & Sibbald, B. (2006). Substitution of doctors by nurses in primary care. *Cochrane Database of Systematic Reviews*. Issue 1. CD001271.

This meta-analysis included 25 articles, related to 16 studies, comparing outcomes of primary care nurses (nurses, NPs, clinical nurse specialists or other APRNs) and physicians. The quality of care provided by nurses was as high as that of physicians. Overall, health outcomes and outcomes such as resource utilization and cost were equivalent for nurses and physicians. The satisfaction level was higher for nurses. Studies included a range of care delivery models, with nurses providing first contact, ongoing care and urgent care for many of the patient cohorts.

7. Lenz, E. R., Mundinger, M. O., Kane, R. L., Hopkins, S. C., & Lin, S. X. (2004). Primary care outcomes in patients treated by nurse practitioners or physicians: Two-year follow-up. *Medical Care Research and Review*, 61(3), 332-351.

The study collected follow-up data from a randomized trial described in Mundinger et al. (2000), which compared outcomes of patients seen by an NP versus those seen by a physician. Eligible participants were interviewed by mail, phone calls or home visits. Data were also collected from medical center billing records for the two-year period after the initial visit. No significant differences were found between the two groups in self-reported health status; satisfaction; disease-specific physiologic measures; or use of specialist, emergency room or hospital care. However, physicians' patients had a higher average primary care utilization than NPs' patients.

8. Roblin, D. W., Becker, R., Adams, E. K., Howard, D. H., & Roberts, M. H. (2004). Patient satisfaction with primary care: Does type of practitioner matter? *Medical Care*, 42(6), 606-623.

This study evaluated the relationship between patient satisfaction and practitioner type during primary care visits at a managed-care organization. The authors used a retrospective observational design to examine 41,209 randomly sampled patient satisfaction surveys between 1997 and 2000. Patients reported higher satisfaction when NPs or PAs saw them than when physicians did.

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9. Mundinger, M. O., Kane, R. L., Lenz, E. R., Totten, A. M., Tsai, W. Y., Cleary, P. D., Friedewald, W. T., Siu A. L., & Shelanski, M. L. (2000). Primary care outcomes in patients treated by nurse practitioners or physicians: A randomized trial. *Journal of the American Medical Association*, 283(1), 59-68.

This study compared outcomes of primary care delivered by NPs and physicians for patients receiving follow-up care after visiting the ED or urgent care. Patients were randomly assigned to either an NP or physician clinic for care between August 1995 and October 1997. Data were collected from telephone and in-person interviews and health services utilization data. There were no significant differences in patient satisfaction, health status, physiological tests or health service utilization between the two provider groups at six months. NPs' patients with hypertension had statistically significant lower diastolic values. Overall, when NPs were in the same setting and held similar authority as physicians, patient outcomes for NPs and physicians were comparable.

10. Brown, S. A., & Grimes, D. E. (1995). A meta-analysis of nurse practitioners and nurse midwives in primary care. *Nursing Research*, 44(6), 332-9.

This meta-analysis of 38 studies comparing outcomes for patients of NPs with those of physicians found that NP outcomes were equivalent to or better than those of physicians. NPs' patients had higher levels of compliance with recommended treatment. Patient satisfaction and the resolution of pathological conditions were greater for NPs. NP and physician care was equivalent for all other outcomes.

11. Safriet, B. J. (1992). Health care dollars and regulatory sense: The role of advanced practice nursing. *Yale Journal on Regulation*, 9(2).

Safriet concluded that NP-delivered care was equivalent to that of physicians based on 12 of the 14 studies reviewed that showed differences in quality found higher quality for NP-delivered care. Reviewing a range of data on NP productivity, patient satisfaction and prescribing, Safriet concluded, "APNs are proven providers, and removing the many barriers to their practice will only increase their ability to respond to the pressing need for basic health care in our country."

12. Prescott, P. A., & Driscoll, L. (1980). Evaluating nurse practitioner performance. *Nurse Practitioner*, 5(4), 28-32.

The authors reviewed 26 studies comparing care provided by NPs and physicians, concluding that NPs scored higher in many areas. These included discussions regarding child health care, preventive health and wellness; amount of advice, therapeutic listening and support offered to patients; completeness of history and follow up on history findings; completeness of physical examination and interviewing skills; and patient knowledge of the management plan given to them by the provider.

13. Congressional Budget Office. (1979). Physician extenders: Their current and future role in medical care delivery. Washington, D.C.: US Government Printing Office.

As early as 1979, the Congressional Budget Office reviewed findings of the numerous studies of NP performance in a variety of settings and concluded that NPs performed as well as physicians with respect to patient outcomes, proper diagnosis, management of specific medical conditions and patient satisfaction.

14. Sacket, D. L., Spitzer, W. O., Gent, M., & Roberts, M. (1974). The Burlington randomized trial of the nurse practitioner: Health outcomes of patients. *Annals of Internal Medicine*, 80(2), 137-142.

This trial randomly allocated a sample of 1,598 families so that two-thirds continued to receive primary care from a family physician and one-third received care from an NP. Four outcome measurements (i.e., mortality rates and physical, emotional and social function) were taken from patients in the trial to observe clinical effectiveness and safety. Results demonstrated comparable outcomes. There were no significant differences in mortality rates between the two study groups. The measurements of physical, emotional and social function in both groups were similar after one year of care.

15. Spitzer, W. O., Sackett, D. L., Sibley, J. C., Roberts, M., Gent, M., Kergin, D. J., Hacket, B. D., & Olynich, A. (1974). The Burlington randomized trial of the nurse practitioner. *New England Journal of Medicine*, 290(3), 252-256.

From July 1971 to July 1972, a randomized controlled trial was conducted in two family practices in Burlington to compare the effects of utilizing NPs or physicians to provide primary care services. This paper detailed the study design, logistics, data and summary of results, also described in Sacket et al. (1974). Of the 1,598 families eligible for the trial, two-thirds were assigned to standard care with a family physician and the other one third was assigned to NPs. A household survey was conducted before and after the experimental period to collect health status and medical services utilization. During the one-year trial, the authors assessed management of preselected indicator conditions and drug prescriptions. Findings suggest that patients had similar mortality rates; quality of care; functional and emotional function; and satisfaction.