

Nurse Practitioner Low-Value Care Ordering Practices: An Integrative Review

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The critical issue of low-value care (LVC) is defined as health care services that are unsupported by current evidence, offer no net benefit in specific clinical situations, and are associated with wasteful spending and harmful patient outcomes.^{1,2} Health care costs associated with LVC have been estimated to reach upwards of \$100 billion annually.³ Prevalence rates of commonly ordered LVC services such as routine preoperative testing for low-risk patients and prostate-specific antigen (PSA) testing in men older than 70 years were 28% and 27%, respectively.⁴ LVC can lead to additional appointments and procedures that cause patient anxiety and poor satisfaction.⁵ Although follow-up costs are difficult to measure, one study estimated that such expenditures related to each LVC range from \$7.46 to \$9.62 per beneficiary.⁶

LVC continues to occur; however, the degree to which nurse practitioners (NPs) contribute remains unclear. Two studies looked at LVC ordering prevalence among clinicians in outpatient settings but omitted analyses by provider type.^{2,7} Other studies that included NPs combined all advanced care providers into 1 category for their analyses.^{8,9} There are approximately 258,000 NPs practicing in the US,¹⁰ enough to analyze them separately from physicians and physician assistants (PAs), making it imperative to understand NPs' role in LVC prevalence.

A wide range of LVC services is ordered in ambulatory care centers,^{2,4,11} and the type and cost of each service can influence the frequency with which it is ordered. Ninety-three percent of LVC services ordered were low cost (\$100-\$538 per service) or very low cost (< \$100) but accounted for 65% of LVC-associated costs.¹¹ This indicates that the less expensive an LVC service is, the more frequently it is ordered.

Conflicting evidence has been collected about the ways in which clinician characteristics impact LVC ordering practices. Having fewer years of practice experience and working in primary care have been associated with both higher and lower LVC ordering.^{12,13} Additionally, patient characteristics influence clinician LVC ordering practices. Ganguli et al found that younger White patients living in urban and high-income areas were more likely to be ordered an LVC service, implying that clinicians order LVC services in response to their patients' characteristics.⁴ Furthermore, practice location

ABSTRACT

OBJECTIVES: Low-value care (LVC) health services are unsupported by current evidence, are associated with harmful patient outcomes, and equate to more than \$100 billion in wasteful spending annually. Nurse practitioner (NP) LVC ordering practices among adult patients in outpatient settings are described and compared with those of other health care clinicians. Factors impacting NP ordering practices are also explored.

STUDY DESIGN: Integrative review.

METHODS: Electronic databases, including MEDLINE's PubMed, CINAHL, Web of Science, and Business Source Complete, and Google Scholar were searched for original studies published prior to April 2023. Search terms included relevant keywords pertaining to LVC and NPs. Results were supplemented by a search of the reference lists of included studies.

RESULTS: Of the 20 included studies, 7 were of low quality, which limited findings. Results comparing NP LVC ordering practices with those of other health care clinicians were conflicting. When compared with physicians, NPs ordered equal rates of antibiotics in 4 studies and lumbar imaging in 6 studies; they ordered less imaging in 2 studies but more imaging in 1 study. In 1 study, NPs ordered fewer lumbar imaging studies than physician assistants. NPs reported following protocols for prescribing and found that patient education and reassurance were successful in minimizing LVC ordering when managing patient expectations. NP specialization appeared to influence LVC ordering, whereas scope of practice laws had no effect.

CONCLUSIONS: The full extent to which NPs order LVC services, as well as a comprehensive understanding of the factors influencing their decisions, remains unknown. It is unclear whether NPs order fewer or equal LVC services compared with other health care clinicians. More research on NPs and LVC is indicated.

Am J Manag Care. 2024;30(3):e93-e102. doi:10.37765/ajmc.2024.89520

TAKEAWAY POINTS

Low-value care (LVC) is associated with more than \$100 billion in wasteful spending annually. This review examined socioecological factors that influence the LVC ordering decisions of nurse practitioners (NPs).

- ▶ Little is known about LVC services ordered by NPs, except for imaging for acute, uncomplicated low back pain and antibiotic prescriptions for acute upper respiratory infections.
- ▶ NPs found patient education and reassurance successful in minimizing LVC ordering.
- ▶ Study results found that NPs ordered fewer or equal LVC services compared with other clinicians, but findings conflicted.
- ▶ Primary care practice, the desire to provide patient-centered care, and relationships with clinician peers may influence LVC ordering among NPs.

and environment have been shown to influence ordering practices. Physicians working at community health centers were less likely to order LVC services compared with those working at private practices ($P < .001$),¹⁴ and rural physicians had lower per-patient LVC spending compared with their urban counterparts ($P < .001$).¹²

This integrative review sought to determine NPs' overall contribution to LVC ordering prevalence, discover whether NP ordering practices differ from those of other clinicians, identify factors contributing to their decisions in outpatient settings, and ascertain the resultant economic impact. The purpose was to describe and analyze the state of evidence concerning LVC ordering practices among NPs in adult outpatient settings. The research questions for this review were: (1) What are LVC ordering practices among NPs caring for adult patients in outpatient settings? (2) How do LVC ordering practices differ between NPs and other health care clinicians in adult outpatient settings? (3) What factors have been identified to impact NP LVC ordering practices in adult outpatient settings? and (4) What are the economic impacts of LVC ordering practices among NPs working in adult outpatient settings?

METHODS

Inclusion Criteria

Original quantitative, qualitative, and mixed-methods studies published in English were considered for this review. Included studies focused on an international sample of NPs caring for individuals 18 years or older in outpatient settings, excluding emergency department (ED) or long-term care. To meet inclusion criteria, a practice guideline with conclusive evidence supporting that a service is low value was required. No time period was specified for studies because older studies can demonstrate trends. This review excluded studies examining polypharmacy; incorrect ordering including wrong diagnosis, medication, or dose; inappropriate opioid or medication prescribing, such as wrong medication combinations or Beers Criteria; and inappropriate referrals to specialists.

Search Strategy

The literature search was conducted from November 2022 to March 2023. Electronic databases, including MEDLINE's PubMed,

CINAHL, Web of Science, and Business Source Complete, and Google Scholar were searched using the following search terms: *low-value, inappropriate, unnecessary, redundant, waste*, un-indicated, overuse, nurse practitioner, midlevel, and advanced practice*. References for each included publication were examined for additional relevant publications. A research librarian was consulted for the search.

Study Quality

Each article was assigned a level of evidence and corresponding quality grade using the

Johns Hopkins Evidence Appraisal Tool.¹⁵ Evidence levels were defined as (I) experimental study or randomized controlled trial; (II) quasi-experimental study; (III) nonexperimental study or systematic review; (IV) opinion of respected authorities and/or nationally recognized expert committees/consensus panels; and (V) case reports or expert commentary based on experiential and nonresearch evidence.¹³ Quality ratings were defined as (A) high, (B) good, and (C) low.¹⁵ Additionally, Grading of Recommendations, Assessment, Development, and Evaluation (GRADE)¹⁶ to assess quantitative studies, and Confidence in Evidence from Reviews of Qualitative Research (CERQual)¹⁷ to assess qualitative studies, were used to assess study quality, and evidence was graded as high, moderate, low, or very low confidence. Studies were evaluated independently by 2 researchers (S.B.N. and R.P.L.) and then the researchers met to reach a consensus on areas where ratings differed.

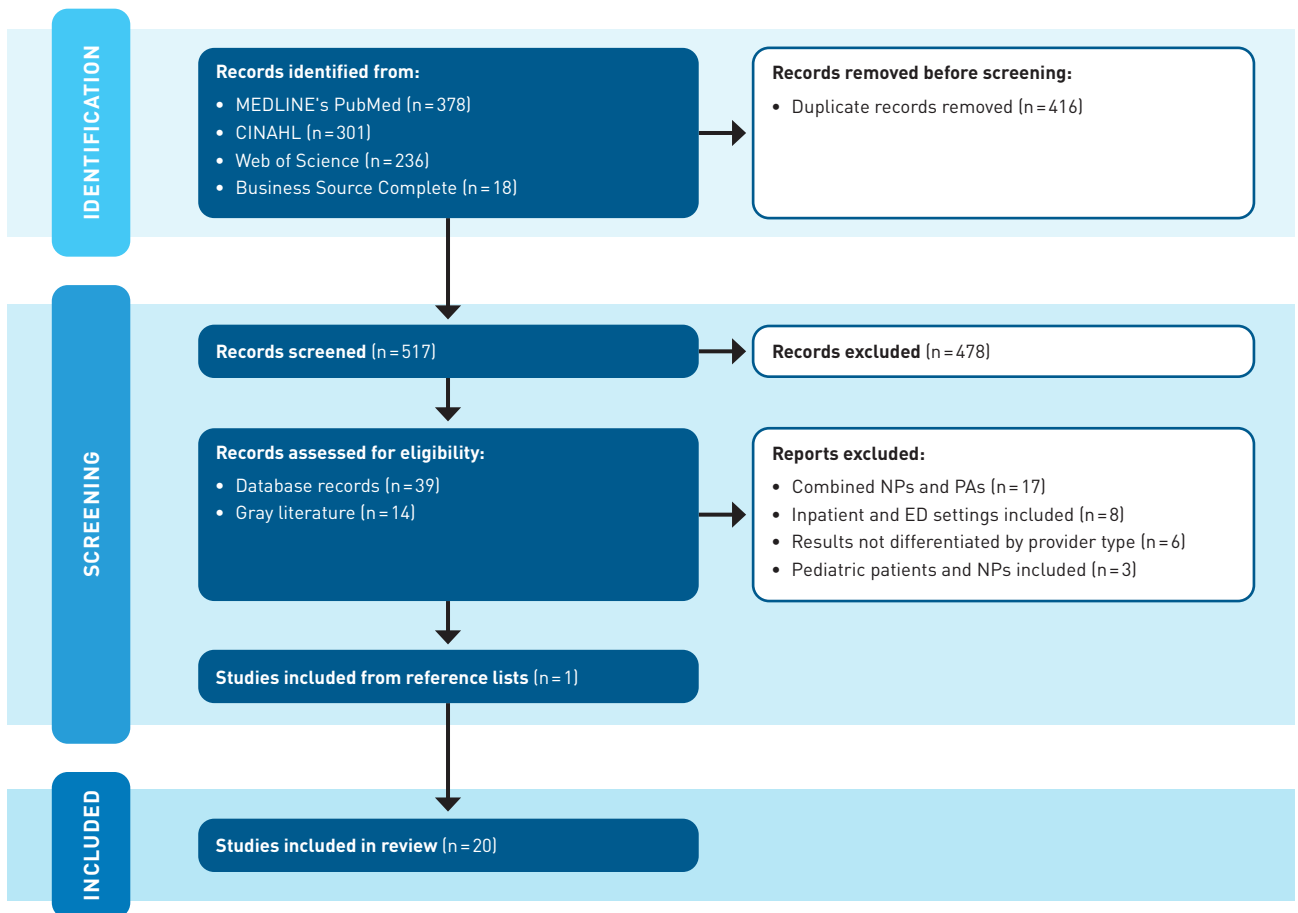
Theoretical Framework

The Social-Ecological Model (SEM) provided a framework to understand the reciprocal influence of NPs and the physical and sociocultural environments that lead to ordering LVC.^{18,19} The SEM includes 5 interconnected environmental levels that may influence NP LVC ordering practices: (1) intrapersonal, (2) interpersonal, (3) institutional, (4) community, and (5) public policy.¹⁸ Incorporating a multilevel framework allows for data categorization that identifies particular NP characteristics and environmental factors influencing NPs' decisions to order LVC.

Screening

Research articles were screened using a 3-stage process (Figure). After removing duplicates ($n = 416$), article titles and abstracts ($n = 517$) were reviewed for possible relevance and either retained for further review ($n = 39$) or discarded ($n = 478$). Additional articles found in the gray literature ($n = 14$) were included for review. Next, articles that appeared to be relevant ($n = 53$) were reviewed with the inclusion criteria applied. One article found in an included article's reference list was added. The included studies ($n = 20$) were read in full and evaluated for quality, reliability, validity, credibility, and trustworthiness, as indicated.

FIGURE. Flow Diagram



ED, emergency department; NP, nurse practitioner; PA, physician assistant.

Excluded Studies

Studies were most commonly excluded because they considered NPs and PAs to be the same type of health care providers without differentiating results by provider type (n = 17). Other reasons included combining inpatient and ED settings without differentiating results by setting type (n = 8), including NPs but not differentiating any results by provider type (n = 6), and including pediatric NPs or patients without differentiating results by provider or patient type (n = 3).

RESULTS

Overview of the Study Sample

Twenty studies published between 2010 and 2023 were included (Tables 1, 2, and 3).²⁰⁻³⁹ There were 1 mixed-methods, 4 qualitative, and 15 quantitative studies. Twelve studies conducted secondary data analyses using Medicare claims records (n = 5),²⁰⁻²⁴ National Ambulatory Medical Care Survey (NAMCS) and National Hospital

Ambulatory Medical Care Survey (NHAMCS) (n = 3) data,²⁵⁻²⁷ military or veterans claims and electronic health records (EHRs) (n = 3),²⁸⁻³⁰ or private claims and EHR data (n = 1).³¹ Three studies used surveys³²⁻³⁴ and 1 was quasi-experimental.³⁵ All qualitative inquiries were descriptive in nature and used either semistructured interviews or focus groups.^{30,35-39}

LVC services studied included lumbar imaging (n = 9),^{20-24,28,29,34,36} antibiotic prescribing for acute upper respiratory infections (URIs; n = 5),^{26,30,35,38,39} lumbar imaging and antibiotic prescriptions for URIs (n = 2),^{27,31} PSA screenings (n = 2),^{25,32} opiate prescribing for acute lumbar pain (n = 1),²⁸ and pelvic examination requirements for oral contraceptives (n = 1).³³

Quality of Included Studies

Seven studies were rated as high quality and high confidence,^{20,21,24,26,28,29,31} 6 as good quality and moderate confidence,^{22,23,33,37-39} 3 as low quality and low confidence,^{25,27,36} and 4 as low quality and

TABLE 1. Quantitative Report Type, Data Type, Study Purpose, and Sample Characteristics of All Reviewed Studies^{20-29,31-35}

Authors (year)	Purpose	Design/methods	Reliability	Validity	LOE	Quality	GRADE	Rationale
Brown (2018) ³⁵	To evaluate the outcome of an antibiotic stewardship program on provider antibiotic prescribing for acute URIs	Quasi-experimental; systematic random chart sampling from 8 urgent care centers; retrospective baseline chart audit pre- and post intervention	Questionnaire test-retest ICC > .4; Cronbach α > .7; ceiling effect in study observed; instrument not piloted	Purposive sampling; low statistical power; unreliability of treatment implementation; intervention not piloted	II	C	Very low	Inadequate sample size with 5 NPs (N=8); not adequately powered; minimal intervention description; not clear if selected patients were treated by participants
Buerhaus et al (2018) ²⁰	To compare quality of PC between NPs and MDs while controlling for patient selection biases and disease severity over an extended time period	Retrospective cohort; secondary data analysis of PC quality measures using 2012-2013 Medicare Parts A and B claims	Secondary data analysis of claims-based data	Random sampling of NPs and MDs; oversampled NPs at a rate of 4:1; weighting by propensity score can increase random error	III	A	High	Adequate sample size and strong statistical analysis; data from across the US; controlled for patient selection biases and disease severity
DesRoches et al (2017) ²¹	To compare quality indicators among 3 groups of vulnerable beneficiaries treated by NPs and MDs	Retrospective cohort; secondary data analysis of PC quality measures using 2012-2013 Medicare Parts A and B claims	Secondary data analysis of claims-based data	Created 3 mutually exclusive cohorts; oversampled NPs	III	A	High	Adequate sample size and strong statistical analysis; data from across the US; weights from descriptive model used in regression analysis
Dietrich et al (2018) ²⁸	To examine differences in providing guideline-concordant imaging and prescription practices for treatment of low back pain among physicians, NPs, and PAs	Retrospective, cross-sectional; secondary data analysis of 2015 Military Health Systems data	Secondary data analysis	Clear inclusion criteria; 6-month walk-back from initial diagnosis code	III	A	High	Adequate sample size; MRI ordering differences between NPs and physicians considered a marginal difference even with 95% CI including 1.00
Gidwani et al (2016) ²⁹	To explore inappropriate use of lumbar spine MRIs in a health system free of financial or legal influences	Retrospective, cross-sectional; secondary data analysis of 2012 VHA claims	Secondary data analysis; MRIs did not have associated diagnosis codes and researchers used preceding clinic visit as the ordering provider	Used NQF-endorsed CMS criteria to evaluate inappropriate ordering	III	A	High	Adequate sample size; utilized previous 2 years of inpatient and outpatient data to evaluate patient care and condition; performed sensitivity analysis on providers ordering > 5 MRIs/year and results did not change

(continued)

very low confidence.^{30,32,34,35} Quantitative studies were rated as low quality and low or very low confidence for inadequate statistical power and sample size for 1 or all analyses^{25,27,34,35} and for implementation of subjective LVC assessment guidelines, no content validity evidence, and possible ceiling effects for the survey used.³² The qualitative study by Fifer et al was assigned a low quality and low confidence rating because finding verification, triangulation, and research teams' biases were excluded.³⁶ The mixed-methods study by Knobloch et al was rated low quality and very low confidence because no evidence of data-merging, data saturation, triangulation, finding verification, research teams' biases, or supporting participants' quotes to substantiate themes was provided.³⁰

Intrapersonal Factors

Three United Kingdom (UK) studies provided information about intrapersonal factors that may influence NPs' LVC ordering practices and may not be representative of all NPs. Compared with physicians, UK nurse prescribers were more likely to be full-time employees and to report ordering from protocol rather than intuition.³⁹ Both nurse prescribers and physicians felt that physicians were more suited to care for complex patients.³⁹ UK nurse prescribers were also more likely than physicians to prefer a second consultation over delayed antibiotic prescribing and to prescribe self-management strategies for patients with URI.³⁷ Additionally, they reported prescribing inappropriate antibiotics for URIs for fear of missing something or

TABLE 1. (Continued) Quantitative Report Type, Data Type, Study Purpose, and Sample Characteristics of All Reviewed Studies^{20-29,31-35}

Authors (year)	Purpose	Design/methods	Reliability	Validity	LOE	Quality	GRADE	Rationale
Gillette et al (2023) ²⁵	To identify the proportion of preventive visits at which low-value prostate cancer screening is ordered by PC clinics and identify patient, visit, and provider characteristics associated with low-value screenings	Retrospective, cross-sectional; secondary data analysis using 2013-2016 and 2018 NAMCS data	Secondary data analysis; clinician-reported survey data; midwives included with NPs; 2017 data unavailable	Clear inclusion criteria; limited sample size for DREs (n=53); included midwives and NPs	III	C	Low	Adequate sample size for PSA and inadequate sample size for DRE; collected data over multiple years; utilized weighted 2-sided logit regression models with $\alpha = .005$ to reduce risk of a type 1 error; independently practicing NPs not adequately represented in NAMCS data
Harper et al (2023) ³²	To evaluate the interest of PC clinicians in utilizing clinical decision support assistance for PSA screening	Cross-sectional; survey of PC clinicians in Utah	Responses based on recall; possible nonresponse bias	Low-value care based on subjective criteria; no content validity evidence for survey; possible ceiling effect on survey	III	C	Very low	Based low-value ordering on ordering > 5 PSA tests in the past year; survey response rate 29%; clinicians who did not get categorized as "rare screener" or "screener" were put in "low-value screener" subgroup
Henderson et al (2010) ³³	To investigate clinicians' requirements for pelvic examination and what may account for practice differences	Cross-sectional; National survey of ob-gyns, family medicine physicians, and APRNs	Responses based on recall; possible nonresponse bias	Stratified probability sampling of eligible participants; clear procedures; used validated questionnaire	III	B	Moderate	Response rate 65.3%; clearly defined variables; data collected 6-7 years after guidelines were released
Jiao et al (2018) ²⁶	To compare the quality of prescribing practices of physicians and nonphysician providers over a wide scope of conditions and ages	Retrospective, serial cross-sectional; secondary data analysis using 2006-2012 NAMCS and NHAMCS data	Secondary data analysis; clinician-reported survey data; minimal missing data	Clinician-reported survey data; for sensitivity analyses, patients seeing an NP and physician were classified as physician visits	III	A	High	Adequate sample size; collected data over multiple years; independently practicing NPs not adequately represented in NAMCS data; excluded visits in analysis where patient saw multiple providers
Le et al (2018) ³⁴	To investigate the importance of various influences on physician decision-making when clinical guidelines differ from patient preference	Cross-sectional; survey (online) of PC clinicians in Maryland and New York	Survey not piloted; possible nonresponse bias	Iterative survey development among coauthors to reach consensus; randomized group assignment; used ACO	III	C	Very low	Response rate 36% (n = 168); completed a priori power analysis (n = 176) but study underpowered; NPs have full practice authority at 2 of 4 sites; NP sample too small to draw conclusions (n = 13)

(continued)

making a mistake³⁸ and reported feeling more accountable for their prescribing than physicians.³⁹ UK nurse prescribers perceived patients as distrustful of their profession when they made a no-prescribing decision³⁹ and felt they lacked the necessary medical authority that physicians possess.³⁸

Interpersonal Factors

Compared with physicians, NP-assigned beneficiaries had fewer comorbidities and tended to be younger and healthier,^{20,22} corresponding with the finding of Williams et al that UK nurse prescribers perceive physicians as caring for more complex patients,³⁹ although some NP-attributed beneficiaries had disabilities.^{20,23} Among

high- and moderate-quality studies, no differences were observed between NP- and PA-assigned beneficiaries.

Compared with other clinicians, results of 1 study found NPs less likely than physicians to order low-value MRI for lumbar pain (adjusted OR [AOR], 0.81; $P < .0001$),²⁰ whereas another found no difference in MRI ordering prevalence among NPs, physicians, and PAs.²⁹ O'Reilly-Jacob et al found no statistically significant difference in radiography, CT, and MRI ordering for lumbar pain.²² Compared with PAs, NPs were less likely to order lumbar imaging in outpatient, non-ED settings (AOR, 0.135; $P < .0001$).²³ Results of 1 study found clinicians were more likely to order inappropriate

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TABLE 1. (Continued) Quantitative Report Type, Data Type, Study Purpose, and Sample Characteristics of All Reviewed Studies^{20,29,31-35}

Authors (year)	Purpose	Design/methods	Reliability	Validity	LOE	Quality	GRADE	Rationale
Mafi et al (2016) ²⁷	To compare use of low-value services among US APCs and physicians	Retrospective, cross-sectional; secondary data analysis using 1997-2011 NAMCS and NHAMCS data	Secondary data analysis; clinician-reported survey data	Clinician-reported survey data; NHAMCS and NAMCS databases analyzed data sets separately	III	C	Low	Small NP sample size (n=70) vs physician reference (n=12,170) and underpowered for NAMCS data (NPs ordered no low-value CTs/MRIs); adequate sample size and power for NHAMCS data; independently practicing NPs not adequately represented in NAMCS data
O'Reilly-Jacob et al (2019) ²²	To compare the frequency of low-value images ordered by PC MDs and NPs for first-time low back pain	Retrospective cohort; secondary data analysis using 2012-2013 Medicare claims	Secondary analysis of claims-based data; 100% sample of all data on claims paid	Low-value back imaging based on guidelines; excluded NPs providing >75% of care to a single diagnostic code to represent specialist (19%)	III	B	Moderate	Adequate sample size and power; 1-year look-back to establish new-onset low back pain; included clinicians with ≥5 beneficiaries to allow for sufficient sample; clear procedures; tested for equivalence of variances due to unequal sample sizes; some PC NPs may have been excluded from analysis
O'Reilly-Jacob et al (2021) ²³	To compare the rates of low-value back images ordered by NPs and PAs	Retrospective cohort; secondary data analysis using 2012-2013 Medicare claims	Secondary analysis of claims-based data	Low-value back imaging based on guidelines; excluded clinicians providing >75% of care to a single diagnostic code, NPs (12.3%) and PAs (15.7%)	III	B	Moderate	Adequate sample size and power (radiography); low power for low-value MRI and CT (only analyzed descriptively); 1-year look-back to establish new-onset low back pain; included clinicians with ≥6 beneficiaries to allow for sufficient sample; some PC NPs may have been excluded from analysis
Perloff et al (2019) ²⁴	To compare quality of primary health care delivered by NPs in states with full, reduced, and restrictive SOP	Retrospective cohort; secondary data analysis using 2012-2013 Medicare claims	Secondary claims-based data analysis	Collected random sample of NPs and MDs; oversampled NPs to account for smaller beneficiary size; included clinicians providing >30% of beneficiary's claims; weighting by propensity score can increase random error	III	A	High	Adequate sample size and power; used AANP's classification system for SOP laws; all quality measures endorsed by NQF with the exception of the NYU algorithm
Smith (2022) ³¹	To evaluate the effect of relaxed NP SOP laws on the provision of low-value services at PC practices	Cross-sectional; secondary data analysis; difference-in-difference using 2011-2017 EHR data from a national database	Secondary claims and EHR data analysis; data set samples NPs who are more concentrated in urban practice	Claims data reflects clinicians who provide care; defined PC practices as having at least two-thirds of physicians and NPs having a PC specialty	III	A	High	Adequate sample size and power; Athenahealth visits overrepresent Medicare and older patients, underrepresent commercially insured and younger patients, and are more geographically concentrated in the South and sparse in the West; clear procedures

AANP, American Association of Nurse Practitioners; ACO, accountable care organization; APC, advanced practice clinician; APRN, advanced practice registered nurse; DRE, digital rectal exam; EHR, electronic health record; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; ICC, intraclass correlation coefficient; LOE, level of evidence; MD, medical doctor; NAMCS, National Ambulatory Medical Care Survey; NHAMCS, National Hospital Ambulatory Medical Care Survey; NP, nurse practitioner; NQF, National Quality Forum; NYU, New York University; ob-gyn, obstetrician-gynecologist; PA, physician assistant; PC, primary care; PSA, prostate-specific antigen; SOP, scope of practice; VHA, Veterans Health Administration.

TABLE 2. Qualitative Report Type, Data Type, Study Purpose, and Sample Characteristics of All Reviewed Studies³⁶⁻³⁹

Authors (year)	Purpose	Methods	Credibility	Trustworthiness	LOE	Quality	CERQual	Rationale
Fifer et al (2022) ³⁶	To learn what prevents PCCs from following guidelines and what tools or support could promote conservative care	Semistructured interviews via telephone of a national sample of full-time PCCs	Interview questions were piloted with 10 PCCs; standardized interview with 1 interviewer; reported concept saturation; theme development from multiple participants; themes supported by participant quotes	No discussion of research teams' bias or reflexivity, negative instances/cases, triangulation, or verifying findings with participants or experts; most PCCs were in fee-for-service model	III	C	Low	Interviews recorded and transcribed verbatim; minimal evidence from previous studies or frameworks to justify their findings; did not mention sampling strategy
Peters et al (2011) ³⁷	To investigate how delayed prescribing is used within UK primary care and the benefits and challenges associated with this strategy	Semistructured interviews of primary care clinicians in the UK; in person (n=47), via telephone (n=2) and clinician-specific focus groups (n=6)	Iterative data collection and analysis processes; reported thematic saturation; clinician-specific groups to minimize outside influence; utilized 2 forms of data collection	Verified themes and findings from experts in multiple fields; no discussion of research teams' bias and reflexivity, member-checking, negative instances/cases, or triangulation	III	B	Moderate	Maximum variance purposive sampling; 2 nurse prescriber-only focus groups (n=5 and n=4); interviews and focus groups audio-recorded and transcribed verbatim; used a grounded theory approach to analysis but not theory generated; used participant quotes to support findings; UK-based study with different SOP and regulations
Rowbotham et al (2012) ³⁸	To explore how nurse prescribers and other NMPs experience URI consultations and the challenges they face in trying to implement a no-prescribing strategy	Semistructured interviews and focus groups of UK primary care nurse prescribers and NMPs by PI; in person and via telephone	At least 2 researchers analyzed interviews; allowed for emergence of new themes; interviews stopped at data saturation; themes supported by participant quotes; no qualitative software utilized	Utilized integrative process; data triangulation; dual data collection method; no discussion of research teams' bias and reflexivity, member-checking, or negative instances/cases	III	B	Moderate	Purposive sampling; interviews were audio-recorded and transcribed verbatim; discussion supported with minimal evidence; some subthemes not well supported (time consuming, lack of continuity of care); UK-based study with different SOP and regulations
Williams et al (2018) ³⁹	To explore PCC views on and experiences of prescribing antibiotics for respiratory tract infections in out-of-hours services	Semistructured interviews of UK urgent care clinicians by 2 investigators; via telephone	Interviews stopped at data saturation; team consensus on coding and themes; described iterative data analysis process; themes supported by participant quotes	Included epistemological position and took a "nonjudgmental" stance but no other discussion of bias and reflexivity, member-checking, or negative instances/cases; rich descriptions; substantial support for findings	III	B	Moderate	Maximum variation sampling and ensured equal mix of rural and urban PCCs; interviews were audio-recorded and transcribed verbatim; UK-based study with different SOP and regulations

CERQual, Confidence in Evidence from Reviews of Qualitative Research; NMP, nonmedical prescriber; NP, nurse practitioner; PCC, primary care clinician; PI, primary investigator; SOP, scope of practice; UK, United Kingdom; URI, upper respiratory infection.

TABLE 3. Mixed-Methods Report Type, Data Type, Study Purpose, and Sample Characteristics of All Reviewed Studies³⁰

Authors (year)	Purpose	Methods	Credibility/reliability	Trustworthiness/validity	LOE	Quality	CERQual/GRADE	Rationale
Knobloch et al (2021) ³⁰	To identify barriers and facilitators to guideline-concordant prescribing among NP prescribers and explore perspectives about perceived roles in antibiotic stewardship efforts	Qualitative: (1) semistructured interviews; in person and via telephone (NPs) (n = 14) and (2) focus groups (veterans) (n = 15) in Wisconsin Quantitative: secondary data analysis using 2017-2019 VHA data	Questions developed by multiple investigators and piloted; skilled focus group leader; secondary data; did not support themes by participant quotes; did not indicate data saturation	Included all outpatient VA NPs' data; patients not necessarily treated by NPs; no discussion of research teams' bias or reflexivity, negative instances/cases, triangulation, or verification of findings	III	C	Very low	Study recruitment in staff meetings only; not clear if veteran participants were cared for by NPs; inductive and deductive analysis guided by the Systems Engineering Initiative for Patient Safety Model; interviews recorded and transcribed; included demographics for NP and veteran participants; findings were not merged as indicated by mixed-methods methodology

CERQual, Confidence in Evidence from Reviews of Qualitative Research; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; LOE, level of evidence; NP, nurse practitioner; VA, US Department of Veterans Affairs; VHA, Veterans Health Administration.

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MRIs for patients younger than 35 years but did not differentiate these results by provider type.²⁹ Statistically significant differences in URI antibiotic ordering between NPs and other clinicians were not observed.^{26,31}

Specialization has also been demonstrated to influence LVC ordering practices among NPs. Henderson et al found that women's health NPs were less likely to always require pelvic examinations for oral contraceptive prescriptions compared with physicians (AOR, 0.59; *P* < .01) or family medicine NPs (AOR, 2.38; *P* < .001); however, direct comparisons among NPs were not done.³³ Other studies excluded suspected specialized NPs in their analyses.^{22,23}

NPs were found to modify their ordering practices to manage patient expectations and out of a desire to provide patient-centered care.^{36,38,39} For example, one NP participant in a low-quality study stated, "There is a lot of pressure from these patients to do MRIs, to be very aggressive."³⁶ In contrast to physicians, nurse prescribers reported finding patient demands for antibiotics less confrontational and were less likely to report yielding to patient requests.³⁷ NPs have found patient education and reassurance successful in minimizing LVC ordering.³⁷⁻³⁹

Relationships among clinician peers can also impact LVC ordering practices among NPs. Nurse prescribers reported appreciating chart auditing and feedback from supervisors,³⁹ and peer support was found to increase clinical guideline adherence and manage patient expectations.³⁸ Unfortunately, limited information could be found on these relationships.

Institutional Factors

Only 1 study examined institutional factors that may influence NP LVC ordering practices and found that nurse prescribers did not feel that length of appointment time contributed to their decisions in ordering antibiotics for URIs.³⁹

Community Factors

Based on the results of 1 study, NPs were more likely to practice in nonmetropolitan areas compared with physicians and PAs.²⁶ Rural women's health (20.8%) and primary care (33.8%) NPs were less likely than their urban and suburban counterparts to always require pelvic examinations for oral contraceptive prescriptions.³³

Some studies controlled for geographic locations with CMS or US Department of Veterans Affairs regions but did not find region to directly affect NPs' LVC ordering.^{20,28} However, after controlling for military geographic region, 1 study found NPs were more likely to order a lumbar radiograph (AOR, 1.15; *P* < .05), less likely to order a lumbar CT (AOR, 0.43; *P* < .05), and less likely to prescribe opiates for acute lumbar pain (AOR, 0.82; *P* < .05) compared with physicians.²⁸

No studies differentiated NP LVC ordering practices among insurance types or between community and private institutions. However, across all provider types, the greatest percentages of inappropriate MRIs ordered were in primary care and internal medicine clinics (62%),²⁹ possibly indicating provider specialization as a more important factor than setting, although insufficient evidence was presented to draw conclusions.

Public Policy Factors

The relationship between NP scope of practice (SOP) laws and LVC ordering practices also has been investigated to varying degrees. Studies in this review included multistate samples without disaggregation,^{20,22-27,31,33,36} sampled states or facilities not offering full practice authority at the time of the study,^{29,31,34,35} considered NPs in a full-practice authority setting,³⁰ and looked at the UK, where nurse prescribers have different SOP standards.³⁷⁻³⁹ Citing Perloff et al,²⁴ Buerhaus et al did not differentiate results by states because there was no evidence demonstrating that state-level SOP restrictions were related to primary care NP quality of care.²⁰ Perloff et al found no statistically significant differences in ordering low-value

imaging for lumbar pain among NPs working in full-, reduced-, and restricted-practice authority states.²⁴ Smith's study echoed these findings for low-value imaging for lumbar pain and antibiotics prescribing for URIs.³¹

Two studies used both NAMCS and NHAMCS data sets,^{26,27} and a third used NAMCS for analysis.²⁵ Interestingly, Mafi et al²⁷ and Lau et al, authors of a commentary not included in the review,⁴⁰ noted that although the NAMCS and NHAMCS data sets collect data directly from providers, the NAMCS uses a sample of office-based physician practices and may not include independently practicing NPs. Jiao et al did not differentiate findings by survey type,²⁶ but Mafi et al did.²⁷ Unfortunately, the NAMCS analysis was underpowered due to the low number of NPs (n=70) compared with PAs (n=82) and physicians (n=12,170) in the sample.²⁷ Without sufficient power to detect differences or differentiate findings by survey type, little is known about physician influence on NPs' LVC ordering. Although the NHAMCS analysis by Mafi et al was sufficiently powered, no significant differences in low-value lumbar imaging and URI antibiotic prescriptions among NPs, physicians, and PAs were observed.²⁷ This may support findings indicating that NP SOP laws do not impact LVC ordering practices.

DISCUSSION

The integrative review surveyed the state of the science on LVC ordering practices among NPs working in primary or ambulatory care settings. The most common LVC services studied among NPs were lumbar imaging for acute uncomplicated lumbar pain and prescribing antibiotics for acute URIs. Compared with physicians, NPs ordered fewer MRIs but had similar rates of radiography and CTs for acute lumbar pain. Compared with PAs, 1 study's results revealed that NPs ordered fewer low-value imaging studies, but this review found insufficient evidence to generalize these findings. No significant differences were found in antibiotic prescribing practices among clinician types. This may indicate that LVC ordering prevalence differs depending on the type of LVC service.

Although little evidence exists to indicate whether intrapersonal and interpersonal factors influence LVC ordering prevalence, nurse prescribers' fear of missing something and their perceived undermining by physicians have been shown to impact their LVC ordering, but more evidence is needed, especially among US NPs.

Regarding practice location, primary care NPs and settings incurred higher rates of LVC services compared with specialized NPs and settings. Another finding indicated that NP SOP laws do not impact lumbar imaging and antibiotic prescribing among NPs. Because some studies found no significant difference in LVC ordering among NPs, physicians, and PAs, it was difficult to determine potential physician influence on NP ordering practices. Based on current findings, no evidence exists indicating that NPs overprescribe any LVC service. Additionally, some evidence suggested that LVC ordering practices among NPs and PAs differed, but more studies evaluating differences in LVC are needed.

There is a need to understand how NPs contribute to ordering LVC services in order to reduce their occurrence and minimize their economic impact. Importantly, this review found no evidence regarding the economic impacts or downstream effects of NP LVC ordering practices in outpatient settings, indicating a need to collect these data. Overall, more data about LVC ordering prevalence among NPs are needed on a multitude of LVC services to examine the full scope of prevalence and the factors influencing NPs' decisions to order LVC services. There is also a strong need to study how NP LVC ordering impacts the relationship among LVC services, their associated follow-up outcomes and costs, and overall patient outcomes.

Limitations

There was a paucity of literature examining the extent to which NPs contribute to LVC prevalence. Many studies did not differentiate all findings by provider type, limiting the generalizability of their findings, as well as the replication of their results. Many included studies used claims-based secondary data analyses or subjective data that may not fully depict NPs' decision processes and care provided, nor did they indicate if the order was needed, which would require a chart review. Qualitative data also may not be representative of all US NPs' characteristics.

CONCLUSIONS

Little is known about the full extent to which NPs contribute to LVC in adult, outpatient settings. Recent literature including NP-specific data has focused mainly on imaging for uncomplicated lumbar pain and antibiotic prescribing for acute URIs. Based on this integrative review's findings, it remained unclear whether NPs ordered fewer or equal LVC services compared with physicians or PAs. Little evidence existed to identify factors influencing LVC ordering practices, specifically in the US. Finally, no evidence existed for the economic impact and downstream effects of LVC ordering practices among NPs. Further research examining LVC services, their economic impact, and the influence of practice settings among the NP population is warranted. ■

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Source of Funding: None.

Author Disclosures: The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (SBN, BIHD); acquisition of data (SBN); analysis and interpretation of data (SBN, RPL); drafting of the manuscript (SBN); critical revision of the manuscript for important intellectual content (SBN, RPL, BIHD); administrative, technical, or logistic support (BIHD); and supervision (RPL).

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