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A Systematic Review of Outcomes Related to Nurse Practitioner-Delivered Primary Care for Multiple Chronic Conditions

Amy McMenamin[1], **Eleanor Turi**[1], **Amelia Schlak**[2], **Lusine Poghosyan**[1]

[1]Columbia University in the City of New York, New York City, USA

[2]Department of Veteran Affairs, Washington, DC, USA

Abstract

Multiple chronic conditions (MCCs) are more common and costly than any individual health condition in the United States. The growing workforce of nurse practitioners (NPs) plays an active role in providing primary care to this patient population. This study identifies the effect of NP primary care models, compared with models without NP involvement, on cost, quality, and service utilization by patients with MCCs. We conducted a literature search of six databases and performed critical appraisal. Fifteen studies met inclusion criteria (years: 2003–2021). Overall, most studies showed reduced or similar costs, equivalent or better quality, and similar or lower rates of emergency department use and hospitalization associated with NP primary care models for patients with MCCs, compared with models without NP involvement. No studies found them associated with worse outcomes. Thus, NP primary care models, compared with models without NP involvement, have similar or positive impacts on MCC patient outcomes.

Keywords

nurse practitioners; primary care; multiple chronic conditions; multimorbidity

Introduction

More than 100 million Americans have MCCs (Buttorf et al., 2017), defined as having two or more physical or behavioral conditions each requiring ongoing treatment and limiting activities of daily living for a year or more (U.S. Department of Health and Human Services, 2010). Among U.S. adults with MCCs, arthritis, diabetes mellitus, heart disease, and hypertension are among the most common conditions (Freid et al., 2012; Meraya et

Corresponding Author: Amy McMenamin, School of Nursing, Columbia University in the City of New York, 560 W 168th St., New York City, NY 10032, USA. alm2314@cumc.columbia.edu.

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Supplemental Material

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al., 2015; Ward & Schiller, 2010). MCCs are often associated with unrelieved, co-occurring symptoms such as fatigue, emotional distress, and pain that can limit daily activities, cause disability, and lead to poor social and occupational functioning (Dreisbach et al., 2022; Jindai et al., 2016). Patients with MCCs commonly have numerous health care providers managing multiple care plans, which often results in care fragmentation—inadequate communication, poor coordination, and lack of teamwork between multiple providers (DuGoff, 2018; Maeng et al., 2012; Savitz & Bayliss, 2021). This care fragmentation is associated with an increased risk of care omissions and medical errors for patients with MCCs (Frandsen et al., 2015; Maciejewski et al., 2017).

Care for patients with MCCs accounts for a disproportionately high concentration of health care expenditures related to emergency department (ED) use and hospitalization, compared with patients without MCCs (Figueroa et al., 2017; Powell et al., 2018; Skinner et al., 2016). Heightened acute care utilization further increases patients' risk of duplicated care and medical errors (Bayliss et al., 2015; Bodenheimer, 2008). Multiple studies have found that a significant portion of this acute care use among patients with MCCs could be prevented by timely, comprehensive, and well-coordinated primary care (Figueroa et al., 2017; Skinner et al., 2016; Steiner & Friedman, 2013).

Achieving the best primary care for people with MCCs will require the skills and abilities of all members of the primary health care workforce, including NPs. NPs have assumed an increasing role in recent decades as primary care providers for people with chronic diseases (Fraze et al., 2020; Xue et al., 2017). While national trends show few physicians entering and staying in primary care (Buerhaus, 2018; Xue et al., 2017), NPs are the nation's fastest growing primary care workforce, with nearly 90% of them trained to deliver primary care (American Association of Nurse Practitioners, 2022; Auerbach, 2012). Furthermore, NPs care for patients with MCCs at rates that match or exceed their physician colleagues (Fraze et al., 2020). For example, among Medicare beneficiaries cared for by NPs in 2017, 25.9% had three or more chronic conditions compared with only 20.8% of those cared for by physicians (Fraze et al., 2020).

Evidence suggests that NPs are well-suited to provide MCC care. Compared with primary care physicians, NP providers offer more regular health education, which is critical for patients with MCCs who often have complicated self-care and medication regimens (Hing et al., 2011; Ritsema et al., 2014). Patients treated by NP-physician teams also experience improved care processes (e.g., guideline adherence) compared with physicians practicing alone, suggesting that NPs are valuable contributors to the care of complex patients, including those with MCCs (Norful et al., 2019). Furthermore, NP education and training emphasize the assessment of a patient's whole health, including the community, social, physiological, and psychological aspects (American Association of Nurse Practitioners, 2022). This training may uniquely prepare the NP workforce to care for patients with MCCs, who often require supportive, personalized care due to their complex needs (Blaum et al., 2018; Muth et al., 2018; Tinetti et al., 2019).

Although NP delivery of primary care is a promising avenue to promote better health outcomes for patients with MCCs, the existing evidence on NPs' contribution to reducing

cost, optimizing service utilization, and improving the quality of health care for MCCs has not yet been synthesized (Savitz & Bayliss, 2021). Thus, our systematic review aims to answer the following question: For patient with MCCs, what are the outcomes of primary care delivered by NPs, compared with primary care delivered without NP involvement, in terms of quality, service utilization, and cost of care?

New Contribution

This review will be the first to summarize existing evidence on the influence of NPs on primary care for patients with MCCs. Prior review studies have addressed outcomes of NP care for other patient populations, primary care models for MCCs, and interventions for managing MCCs in the primary care setting, but none have focused on reviewing the influence of primary care NPs on MCC outcomes (Savitz & Bayliss, 2021; Smith et al., 2012; Swan et al., 2015). In primary care settings, NPs may provide continuous, ongoing care to their own patient panels (Poghosyan et al., 2017). However, NPs also increasingly participate in team-based models of care, such as physician-NP co-management (Norful et al., 2019). They may also assume special roles related to medication management or transitional care such as conducting medication reconciliation visits or follow-up phone calls (Mora et al., 2017). This review will address all potential models of NP care to inform future research, practice, and policy changes that support NP primary care of MCCs.

Conceptual Framework

This review was guided by the Donabedian Quality of Care framework, which posits that the *structure* of organizations influences the processes and outcomes of care (Donabedian, 1988). *Structures* are health care systems, settings, and resources that influence providers' capacity to provide care. *Processes* are the patients' and practitioners' activities during care. Finally, *outcomes* refer to the impact that health care services have on the wellbeing of the patient or the population. Guided by Donabedian's framework, we synthesized published evidence on the *outcomes* of NP primary care for patients with MCCs, and considered the role of *structures* and *processes* on producing differential outcomes.

Methods

Search Strategy

We conducted a systematic review following an *a priori* protocol (PROSPERO 2022 ID = CRD42022325814) and used processes specified in the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (Aromataris & Munn, 2020). We harvested more than 30 search terms referring to, or associated with MCCs, including "multimorbidity," "medically complex," "super-utilizing," and "polypharmacy." Using Boolean operators, we combined these in a search with terms referring to NPs and terms referring to primary care (see Supplemental File 1). We performed the search in April 2022 in PubMed, Embase, Scopus, CINAHL, ProQuest, and PsycINFO. We conducted a gray literature search in Google Scholar (Haddaway et al., 2015), and a hand search of reference lists and select journals (*Journal of Nurse Practitioners*, the *Journal of the American Association of Nurse Practitioners*, and the *Journal of Multimorbidity and Comorbidity*). We followed the

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Figure 1; Page et al., 2021a).

Inclusion and Exclusion Criteria

This review included empirical studies, published in English that examine NP primary care in the United States. As the purpose of our review was to examine all available evidence and identify gaps in the literature, we included all quantitative study designs (e.g., randomized controlled trials [RCTs], quasi-experimental, cohort, and cross-sectional designs). In the included studies, NP care could be delivered either as a solo NP provider or on an interdisciplinary team. Patients were adults (age ≥18) with ≥2 chronic conditions (including behavioral health or substance use disorders). Study populations could either be completely or partially defined by MCCs (e.g., "super-utilizers" who may be defined by both MCCs and frequent service use). Concurrent with the literature, polypharmacy (≥5 daily medications) was considered a proxy for MCC (Gnjidic et al., 2012; Schneider et al., 2021; Thorell et al., 2020). In addition, patient populations at risk for adverse outcomes (e.g., hospitalization and death) as determined by a validated tool that incorporates patients' number of medical conditions (e.g., Charlson Comorbidity Index, which estimates patient risk of death based on the weighted impact of their comorbid diseases) were included.

All existing alternative care models (e.g., physician or physician assistant [PA] delivered care without NP involvement) were considered as comparators. Per our *a priori* protocol, studies where NP-delivered primary care was compared with "usual care" were also included if all other criteria were met. Outcomes included quality of care, service utilization, or cost of care. All eligible studies published prior to the search were included.

Screening Process

Titles and abstracts were uploaded into *Covidence* (Veritas Health Innovation, Melbourne, Australia). After duplicates were removed, the title and abstract were screened, followed by a full-text review of the reports by two independent reviewers (A.M, E.T., and/or A.S.). Conflicts in authors' inclusion/exclusion decisions were resolved by an independent third author (A.M, E.T., and/or A.S.)

Data Extraction

Once studies were screened for eligibility, two reviewers independently extracted data following the JBI extraction guidelines (A.M, E.T., and/or A.S.). The study designs, sample sizes, patient characteristics, definitions of MCCs, settings, care models, follow-up periods, comparators, analytic methods, key results, and funding sources were extracted from each study. Study designs were differentiated based on the following criteria: (a) RCTs were considered intervention studies that randomized participants into intervention and control groups; (b) quasi-experimental studies were considered those that introduced an intervention and measured outcomes before and after, but lacked randomization and/or a control group; (c) cross-sectional studies involved no experimental manipulation and measured both the exposure and outcome at the same time point; and finally, (d) cohort studies were considered those that identified both exposed and nonexposed participants from a defined population

and examined the incidence of an outcome either retrospectively or prospectively (Celentano & Szklo, 2019; Harris et al., 2006; Tufanaru et al., 2020).

Risk of Bias Assessment

We assessed methodological quality using critical appraisal checklists developed by the JBI. As the JBI critical appraisal schema does not allow for a direct comparison of quality appraisal scores between different study designs, we compared quality assessments within study designs only (Aromataris & Munn, 2020). Each item on the checklists has responses of *yes, no, unclear*, or *not applicable* (Aromataris & Munn, 2020). We awarded a percentage score based on the number of items scored *yes* divided by the total items. In alignment with prior publications, the risk of bias was rated as low (≥70%), moderate (50%–69%), or high (≤49%) (Ancheta et al., 2021; Lam et al., 2019; Melo et al., 2018). Conflicts in risk of bias assessments were also resolved through independent review by a third author (A.M, E.T., and/or A.S.). We did not exclude studies based on the quality appraisal.

Results

Literature Search

We found 1,682 records. There were 694 duplicates, leaving 988 records for title and abstract screening. Of these, 938 records did not meet inclusion criteria, leaving 50 reports for full-text review. Of the 50 reports, we excluded 35 because the population (n = 13), interventions (n = 6), comparators (n = 3), outcomes (n = 6), or settings (n = 2) did not meet inclusion criteria. Furthermore, two reports were excluded because they were conducted outside the United States, and three were excluded because they were duplicates not previously identified. In total, 15 studies met the inclusion criteria (Figure 1).

Study Characteristics

Among the 15 included studies, data years ranged from 2003 to 2021. Eleven studies had experimental designs, including eight quasi-experimental studies (Christianson-Silva et al., 2021; Hummel et al., 2017; Kobb et al., 2003; Lenaghan, 2019; Mailliard et al., 2019; Mallow et al., 2018; Sharma et al., 2013; Talley et al., 2021) and three RCTs (Druss et al., 2017; Litaker et al., 2003; Zulman et al., 2017). Four studies used observational design including two cohort studies (Garfein et al., 2021; Morgan et al., 2019) and two crosssectional studies (Chou et al., 2021; Fraze et al., 2020). Data extraction is summarized in Table 1.

Critical Appraisal

We performed quality assessments using the JBI appraisal tool that corresponded to each study's design. The JBI scoring criteria provided a standardized approach to assess the risk of bias within (though not between) study designs. We compared scores from similar study designs to inform our overall assessment of risk of bias. The RCTs (n = 3) had a high risk of bias (scores: 46%) due primarily to unclear reporting on randomization, allocation concealment, and blinding procedures. Within the eight quasi-experimental studies, quality scores were variable, receiving high (n = 2; scores: 33%–44%), moderate (n = 4; scores: 55%), and low (n = 2; scores: 77%) risk of bias scores. The average score for the quasi-

experimental designs was 56% (moderate), and most studies lost points due to dissimilarity of treatment groups, unclear reporting on the care provided across treatment groups, and inappropriate statistical analysis (e.g., descriptive statistics when inferential statistics could have been employed). In addition, we noted other methodological weaknesses in the quasi-experimental studies such as unclear or short follow-up periods (i.e., 30 days; Lenaghan, 2019; Sharma et al., 2013), and small sample sizes (i.e., only 25–30 participants; Lenaghan, 2019; Mallow et al., 2016).

For the observational studies included in the review, we rated all cross-sectional studies (n = 2) as having a low risk of bias (both scores: 88%), which encompasses the valid and reliable measurement of exposure and outcome, and clearly defined inclusion criteria. We also found the cohort studies (n = 2) to have low risk of bias, indicating (among other criteria) that study groups were recruited from the same population and were free of the outcomes at the start of the study (score: 73%–90%; average score: 81.5%). The full quality appraisal can be found in Supplemental File 2.

Structures

NPs provided care for MCCs in a variety of health care settings that have different resources for care delivery. For example, studies were conducted in community clinics (Mailliard et al., 2019; Mallow et al., 2018; Sharma et al., 2013), a federally qualified health center (FQHC; Druss et al., 2017), primary care clinics within academic medical centers (Christianson-Silva et al., 2021; Litaker et al., 2003; Talley et al., 2021), and within the Veterans Health Administration (Hummel et al., 2017; Kobb et al., 2003; Zulman et al., 2017). The integration of NP telehealth structures into care for patients in rural areas was represented in two studies, paired with either remote physiologic monitoring or care coordination services (Kobb et al., 2003; Mallow et al., 2018). Six studies reported patients' insurance coverage. Two studies represented patients with Medicare coverage (Chou et al., 2021; Fraze et al., 2020); one represented Medicaid coverage (Christianson-Silva et al., 2021); and three represented a mix of Medicare, Medicaid, and private insurance coverage (Druss et al., 2017; Sharma et al., 2013; Zulman et al., 2017).

More than half (8/15) of studies examined primary care delivered by interdisciplinary teams, which included NPs (Christianson-Silva et al., 2021; Druss et al., 2017; Hummel et al., 2017; Kobb et al., 2003; Litaker et al., 2003; Sharma et al., 2013; Talley et al., 2021; Zulman et al., 2017). Yet, there was variability in NP roles and team compositions. For example, three studies examined teams led by an NP (Christianson-Silva et al., 2021; Hummel et al., 2017; Talley et al., 2021). On these NP-led teams, members included registered nurses (RNs), community health workers, and social workers, with support from physicians. A sole study examined NP-physician co-management of MCCs, where NPs and physicians worked together to lead care (Litaker et al., 2003).

Processes

Targeted Care.—In five studies, NPs delivered targeted care to patients with special needs, such as those requiring transitional care, those with unmet needs related to medication management, or those with frequent acute care use indicating the need for

enhanced care. Primary care clinicians or discharging teams identified these patients and referred them to an NP who provided supplementary primary care services tailored to their specific needs. The targeted services included goal setting (Hummel et al., 2017), care coordination among patients' providers (Garfein et al., 2021; Hummel et al., 2017; Lenaghan, 2019; Zulman et al., 2017), telehealth services (Kobb et al., 2003), and medication review (Mailliard et al., 2019).

Interdisciplinary Team Collaboration.—Eight studies investigated the effectiveness of interdisciplinary team collaboration led by or involving NPs as a primary care process for patients with MCCs (Christianson-Silva et al., 2021; Druss et al., 2017; Hummel et al., 2017; Kobb et al., 2003; Litaker et al., 2003; Sharma et al., 2013; Talley et al., 2021; Zulman et al., 2017). Of the studies examining this approach, two evaluated evidence-based practice "bundles," including care coordination, goals assessment, health coaching, medication reconciliation, and engaging patients' support network (Christianson-Silva et al., 2021; Zulman et al., 2017). Other studies focused on the addition of behavioral health services to an NP primary care team (Druss et al., 2017; Talley et al., 2021).

Technology Integration.—Two studies explored technology integration into NP primary care for MCCs (Kobb et al., 2003; Mallow et al., 2018). One investigated NP telehealth for veterans and paired with care coordination services (Kobb et al., 2003). The other incorporated web-based remote physiologic monitoring of blood glucose, blood pressure, and body weight using patients' mobile devices (Mallow et al., 2018). Both studies of technology integration in NP primary care were conducted in rural health settings.

Guideline Adherence.—All studies examining guideline use ($n = 5$) reported greater guideline adherence associated with NP care compared with care delivered without NP involvement. In the RCT by Druss et al. (2017), patients receiving integrated behavioral health care from NPs were more likely to receive indicated treatment for diabetes, hypertension, and dyslipidemia compared with those not receiving integrated NP care (67%–81% vs. 65%–63%, $p < .001$; Cohen's $d = 0.7$). In another RCT by Litaker et al. (2003), patients with MCCs treated by an NP-physician team received more health education and preventive care, including education on medication side effects (100% vs. 38%, $p < .001$), vaccination (62% vs. 37%, $p < .001$), and foot examination (79% vs. 28%, $p < .001$) compared with those treated by a physician alone. Furthermore, a quasi-experimental study by Hummel et al. (2017) reported higher rates of appropriate hospice referral among those enrolled in NP-led intensive primary care compared with patients enrolled in usual primary care (74% vs. 44%; $\chi^2 = 4.995$, $p = .025$). Two studies examined the effectiveness of NP care in reducing inappropriate prescribing and simplifying medication regimens compared with physician care without NP involvement (Chou et al., 2021; Mailliard et al., 2019). A cross-sectional study by Chou et al. (2021) found that NPs' patients with more than five chronic conditions had 52% lower odds of inappropriate prescriptions than those of physicians. Similarly, a Quasi-experimental study by Mailliard et al. (2019) reported that NPs, assuming a special medication management role, improved the medication regimens of 98% of patients by assessing for inappropriate medications and discrepancies, though only descriptive statistics were reported.

Outcomes

Patient Outcomes.—Four studies assessed the impact of NP care on physiological or psychological outcomes. The RCT and a quasi-experimental study found that NP care was associated with modest improvements in diabetes measures (i.e., HbA1c and blood glucose) and blood pressure compared with physician-only teams or pre-intervention measures (Litaker et al., 2003; Mallow et al., 2018). However, the RCT found that NP care was associated with no effect on these outcomes compared with usual care (Druss et al., 2017). None of the studies found any association between NP care and changes to cholesterol levels (Druss et al., 2017; Litaker et al., 2003), body mass index (Mallow et al., 2018), depressive symptoms (Mallow et al., 2018; Talley et al., 2021), or anxiety (Talley et al., 2021).

Four studies assessed the association between NP care and patient confidence, empowerment, engagement in health care, and health-promoting behavior. A quasi-experimental study by Lenaghan (2019) found that NP-led transitional care was associated with improved patient empowerment scores, specifically in the confidence and belief subscales of the Senior Empowerment and Patient Safety (SEAPS) survey, confidence subscale, $t(24) = 3.612$, $p = .001$; belief subscale, $t(24) = 6.058$, $p < .001$. Similarly, a quasi-experimental study reported that patients with diabetes and cancer had greater empowerment for diabetes self-management after receiving NP care (4.04 pre-intervention vs. 4.59 postintervention, no p value reported; Sharma et al., 2013). Another quasi-experimental study found that NP primary care with integrated behavioral health care was associated with a reduction in tobacco use among highly engaged heart failure patients with behavioral health conditions (nonsmokers: 56.5% vs. 62.6%, $p = .033$; Talley et al., 2021). However, the RCT by Druss et al. (2017) found no change in patient activation, defined as a patient's capacity to manage their illness, after NP primary care with integrated behavioral health care among patients with serious mental illness and cardiometabolic disease, compared with usual care.

Health Care Service Use.—Six out of 15 studies in this review explored the impact of NP primary care on service use including hospitalization, ED use, and outpatient services for patients with MCCs. Out of the six studies that examined hospitalizations, three (50%) reported a reduction in hospitalizations associated with NP care (Christianson-Silva et al., 2021; Kobb et al., 2003; Sharma et al., 2013). Specifically, in a quasi-experimental study of Medicaid patients, NP primary care was associated with a 35.3% decrease in hospitalizations at 6 months compared with baseline data (Christianson-Silva et al., 2021). In another quasi-experimental study, NP primary care via telehealth was associated with 60% fewer hospitalizations in rural patients with MCCs at 12 months, compared with baseline data (Kobb et al., 2003). Finally, a quasi-experimental study observed a slight (3.4%) reduction in acute care use (i.e., both ED use and hospitalization combined) among patients receiving integrated cancer and diabetes care from NPs, compared with a similar group of patients from the prior year; however, no follow-up period nor statistical significance was reported (Sharma et al., 2013). On the contrary, one cross-sectional study of Medicare beneficiaries in 2017 (Fraze et al., 2020) and the RCT of high-risk Veterans Health Administration patients (Zulman et al., 2017) found that NP care was associated with equivalent hospitalization rates compared with physician care or pre-intervention

measurements, respectively. Furthermore, one cohort study of cardiac patients with high Charlson Comorbidity Index scores found that NP primary care was associated equivalent rates of hospital readmission compared with baseline data (Garfein et al., 2021).

The impact of NP care on ED utilization also produced mixed results. Two quasi-experimental studies reported a reduction in ED visits after NP care compared with baseline data (Christianson-Silva et al., 2021) or usual care (Kobb et al., 2003). In addition, one quasi-experimental study found a slight reduction in combined ED use and hospitalization, compared with a similar patient cohort from the prior year (Sharma et al., 2013). However, half (3/6) of the studies measuring ED use found no change in patients' number of ED visits associated with NP care, compared with physician providers (Fraze et al., 2020), or baseline data (Garfein et al., 2021; Zulman et al., 2017).

Finally, one study reported an increase, and one study reported a decrease in outpatient visits associated with NP care (Druss et al., 2017; Kobb et al., 2003). Specifically, in an RCT, NP care was associated with a higher count of outpatient visits by patients with mental illness and cardiometabolic disease receiving integrated behavioral care after 6 months compared with usual care (NP care: 0.93–1.73 visits; usual care: 0.65–0.86 visits, $p < .001$; Druss et al., 2017). Furthermore, in a quasi-experimental study, patients receiving remote monitoring and care coordination via telehealth from NPs had 4% fewer clinic visits compared with baseline at 12 months (Kobb et al., 2003).

Cost of Care.—Four studies measured the cost of care as an outcome of NP care for MCCs (Christianson-Silva et al., 2021; Fraze et al., 2020; Morgan et al., 2019; Zulman et al., 2017). Half of these studies found decreased costs associated with NP care. For instance, in a large, national cohort study of Veteran Health Administration patients with MCCs, those cared for by NPs incurred 6% lower annual expenditures compared with patients cared for by physicians (95% CI = [3, 9], $p < .001$; Morgan et al., 2019). A small quasi-experimental study of Medicaid patients with MCCs in a single medical center found a 40.6% decrease in total adjusted ED charges, and a 50.3% decrease in adjusted hospital total charges associated with NP care, compared with baseline data (Christianson-Silva et al., 2021). However, one RCT conducted among 583 high-risk veterans found no difference in total health care costs among those who received intensive NP care more than 16 months compared with baseline data (Zulman et al., 2017). Finally, a large, national cross-sectional study of Medicare beneficiaries found that total annual costs were slightly higher for patients cared for by primary care NPs compared with physicians (US$10,644 [NPs] vs. US$10,145 [physician]); however, most of the difference in total cost was driven by long-term care and skilled nursing facility payments (US$1,667 vs. US$970; Fraze et al., 2020).

Discussion

To our knowledge, this is the first systematic review to synthesize the literature examining NP primary care for patients with MCCs in the United States. Our analysis revealed that NPs are commonly employed in community health centers or Veterans Health Administration clinics, where they often provide interdisciplinary, team-based care, or targeted interventions for patients with MCCs. While several studies investigated the outcomes of MCC care

delivered by NPs and physicians who provide primary care to their own patients, most studies focused on interdisciplinary teams, often in special roles such as care coordination, medication management, telehealth monitoring, and transitional care services. Within the included studies, we identified a wide range of quality, service use, and cost outcomes associated with NP care of MCCs. Overall, the body of literature suggests that primary care models involving NPs are effective at delivering cost-effective primary care that aligns with guidelines, supports patient self-management, and contributes to similar hospitalization and ED use outcomes compared with primary care models without NPs.

In our review, we examined various study designs (RCTs, quasi-experimental, cohort, and cross-sectional) to assess the impact of NP primary care models on patients with MCCs. We evaluated each design for potential biases and found that the RCT evidence scored poorly. However, all RCTs maintained a pragmatic approach, indicating that their primary aim was to determine the effectiveness of the intervention in a typical care environment (Zwarenstein et al., 2008). As such, interventions were trialed with a wide range of participants and applied flexibly, as they would be in normal practice (Zwarenstein et al., 2008).

While these real-world conditions are valuable for promoting external validity to the usual care setting, they can pose challenges for investigators trying to implement certain aspects of traditional RCTs (Zwarenstein et al., 2008). For example, it may have been difficult to blind providers to their membership on NP-physician teams due to their existing familiarity with each other, or blind a clinic's current patients to their newfound receipt of integrated behavioral health care (Aromataris & Munn, 2020; Druss et al., 2017; Litaker et al., 2003). However, despite these limitations, we concluded that the evidence from the RCTs was valuable and should be included in the review, as the deficiencies in the studies' conduct were largely explained by their pragmatic approach. We also noted the lack of critical appraisal tools for pragmatic trials, which future developers should consider addressing.

In our review, the cohort and cross-sectional studies performed well on our critical appraisal, while the quasi-experimental studies received moderate scores. However, we observed that these studies did not use causal inference statistical methods, which represents a missed opportunity to move beyond associative statistics and establish causality, especially in low-resource settings where RCTs may be infeasible (Hammerton & Munafò, 2021; Kim & Steiner, 2016). To address this issue, investigators may consider employing more complex statistical approaches, which may require advanced training to use and interpret.

Two potential approaches to support investigators in using these more advanced statistical techniques are practice–research partnerships and practice-based research networks. Practice–research partnerships involve collaborations between clinicians and scientists with advanced methodological and statistical training to support clinical research (Cato et al., 2019). Meanwhile, practice-based research networks enable primary care clinicians and researchers from multiple practices to collaborate on robust research, creating strong research partnerships (Agency for Healthcare Research and Quality, 2018). By leveraging these approaches, investigators can combine rigorous statistical analysis with clinical insights into NP care of MCCs, potentially yielding more robust and informative results.

Our synthesis of evidence revealed several findings regarding the structures, processes, and outcomes of NP care for patients with MCCs. Interdisciplinary collaboration that incorporates NPs may be particularly important when addressing the complex medical and social needs of patients with MCCs. For example, two experimental studies of NP care evaluated multidisciplinary “bundle” interventions, which sought to unite and leverage entire primary care teams to advance care for MCCs (Christianson-Silva et al., 2021; Zulman et al., 2017). The studies suggested that NPs may to be well-positioned to lead teams composed of RN care coordinators, community health workers, social workers, and others (Christianson-Silva et al., 2021; Zulman et al., 2017).

Although team care may be ideal for MCCs, provider shortages in rural and underserved areas make interdisciplinary collaboration challenging. In these cases, NPs may also be effective at incorporating technology such as telehealth into care (Kobb et al., 2003; Mallow et al., 2018). Quasi-experimental studies included in this review showed NP primary care delivered via telehealth to people with MCCs was associated with reduced need for acute care usage and improved physiologic measures such as blood pressure and mean random glucose (Kobb et al., 2003; Mallow et al., 2018). Future studies should further investigate both the optimal team composition for NP care delivery for MCCs and the role of technology in supporting MCC care.

Providing targeted care specifically designed for individuals with MCCs may be a potential avenue for NPs to improve care for these patients. Several studies in this review show that targeted primary care, which may consist of goal setting, care coordination, medication review, walk-in appointments, and/or after-hours support, may be particularly effective when delivered during vulnerable time periods such as the transition out of acute care or rehab (Garfein et al., 2021; Hummel et al., 2017; Kobb et al., 2003; Lenaghan, 2019; Zulman et al., 2017). Future studies should examine the contexts and time periods (e.g., during care transitions) where NPs are best able to provide targeted primary care to groups of patients with special needs.

This review suggests that NP primary care models are associated with improved patient self-management and health-promoting behavior outside of the primary care setting. Two quasi-experimental studies included in the review found that NP care was associated with improved self-care confidence and behaviors like smoking cessation (Lenaghan, 2019; Talley et al., 2021). In addition, prior research has emphasized the importance of community support for health-promoting behaviors between visits, particularly in the context of MCC care (Bierman et al., 2021; Savitz & Bayliss, 2021; Vick & Wolff, 2021). Correspondingly, three quasi-experimental studies in this review suggest that NP identification of patients’ health goals and involvement of patients’ support networks was associated with improved self-care behaviors (Lenaghan, 2019; Sharma et al., 2013; Talley et al., 2021). As such, it would be beneficial for future research to explore whether NPs are uniquely skilled at connecting MCC patients with community resources and supporting their self-care processes both within and between visits, compared with other provider types.

Five varied studies in this review suggested that NPs provide primary care for MCCs that is concordant with established guidelines (Chou et al., 2021; Druss et al., 2017;

Hummel et al., 2017; Litaker et al., 2003; Mailliard et al., 2019). Yet, the prevalence of single-disease focused clinical practice guidelines is a challenging issue for all providers of MCC care. Clinical trials addressing chronic conditions often exclude participants with MCCs, and as a result, the needs of people with MCCs are poorly represented in resulting clinical practice guidelines (Buffel Du Vaure et al., 2016; Fortin & Smith, 2013; Muth et al., 2018). In this context, experts have suggested that a primary care philosophy more closely aligned with patient priorities than individual clinical practice guidelines could better address the accumulated burden of illness (Blaum et al., 2018; Freytag et al., 2020; Tinetti et al., 2019). For example, the Whole Health approach to patient care, which prioritizes patient-centeredness and alignment of care with patients' priorities, has been successfully implemented in the Veterans Health Administration, the largest integrated health system in the United States that employs more than 7,000 NPs (U.S. Department of Veterans Affairs, 2022; VA News, 2022). Expanding models like Whole Health to NP care in other primary care settings may be particularly beneficial for patients with MCCs. In addition, to fully realize the benefits of NP care for these patients, it is also essential to develop clinical practice guidelines that specifically address the needs of individuals with MCCs.

In this review, half of the studies that measured acute care use found a reduction in hospitalizations and ED use for patients who received NP care, while the other half found no significant difference compared with care models without NPs (Christianson-Silva et al., 2021; Fraze et al., 2020; Garfein et al., 2021; Kobb et al., 2003; Sharma et al., 2013; Zulman et al., 2017). However, we noted that the latter studies generally had larger sample sizes and higher methodological quality. Thus, the overall body of literature suggests that NP primary care is equivalent to care models that do not involve NPs in terms of reducing ED use and hospitalization for patients with MCCs. Future work must consider the community and clinic contexts of NP care when interpreting service use outcomes. It is possible that reduced need for hospitalization may indicate better disease control. However, reduced ED use may correspond more closely with the availability of primary care, such as after-hours care, availability of appointments, and accessible clinic locations, or personal factors that inform patients' decision to go to the ED.

In our review, one study found that NP care increased outpatient visits compared with usual care (Druss et al., 2017), while another study found that it decreased outpatient visits compared with baseline (Kobb et al., 2003). The interpretations of these studies differ based on their specific contexts. In the first study, the increase in visits indicated consistent attendance at appointments among individuals with serious mental illness and cardiovascular disease, suggesting effective health management related to NP care for this population. Conversely, the second study observed a decrease in in-person clinic visits among rural veterans with MCCs, such as diabetes and heart failure. These patients were receiving remote monitoring and care coordination via telehealth from NPs, and the reduction in clinic visits suggests that patients embraced the use of these technologies to manage their chronic diseases from home. The decrease in clinic visits in this case represents the avoidance of visits and resource consumption through the utilization of telehealth and remote monitoring by NPs. These studies are noncomparable due to their differences. However, within their respective contexts, both indicate favorable outcomes of NP care for MCCs.

This review suggests several practice and policy initiatives that could improve the care of patients with MCCs. State and federal funding should be invested to support NP care for this population. For example, NPs in FQHCs and Rural Health Clinics can bill Medicare for care coordination services provided to patients with MCCs (Centers for Medicare and Medicaid, 2022b). This could be expanded to other settings to support NP care of MCCs. Furthermore, in response to the Coronavirus 2019 public health emergency, state and federal law makers expanded regulations governing NP primary care visits via telehealth and telephone (Centers for Medicare and Medicaid, 2022a). Some of these expansions will be withdrawn now that the public health emergency has ended. Yet, the continued ability of NPs to bill Medicare for a wide range of telehealth and telephone services may help expand the accessibility of primary care for MCC patients, particularly those residing in rural areas. Finally, clinical trials designed for patients with MCCs should be prioritized for state and federal grant funding to produce evidence for clinical practice guidelines.

Limitations

Our synthesis of the evidence was affected by several limitations of the reviewed studies, as well as heterogeneity between studies. First, many sources of claims data (e.g., Medicare claims and commercial claims) are affected by incident-to billing, where NP care is billed under a physician's name to garner higher reimbursement, thus obscuring the true effect of NP care. Two studies in our review used Medicare claims to examine NP practice, and these may underestimate NPs' contribution to care (Chou et al., 2021; Fraze et al., 2020).

Next, NP care may also be affected by state scope of practice (SOP) regulations. SOP regulations determine the level of autonomy and independent practice for NPs in a certain state (American Association of Nurse Practitioners, 2021). In reduced and restricted environments (where NP practice requires the mandatory collaboration or supervision of physicians), any comparison between NP and physician prescribing is limited. One study in this review (Chou et al., 2021) compared differences in potentially inappropriate prescribing between NPs and physicians in Texas, a highly restricted practice environment where Schedule II prescriptive authority is only authorized in select settings and practice types (Barton Associates, 2021). In this context, results should be interpreted carefully, as NPs lack authority to prescribe all medications. A high proportion (7/15) of the studies in this review were conducted either in states like New Mexico or Arizona, or in the Veterans Health Administration, where NPs have full practice authority. Nonetheless, differing state regulatory environments impact NP practice (Yang et al., 2017) and created a methodological challenge for the synthesis of findings across studies.

Our review aimed to encompass all populations with MCCs, as defined by the U.S. Department of Health and Human Services (HHS) as two or more physical or behavioral conditions requiring ongoing treatment and limiting activities of daily living for a year or more (U.S. Department of Health and Human Services, 2010). The specific combinations of chronic conditions that defined each population with MCCs varied widely based on the purpose of the study, data availability, outcomes examined, and stakeholder preferences (see Supplemental File 3 for a list of how MCCs were determined in included studies). To draw more definitive conclusions from synthesis and meta-analysis, further work is needed to

systematically classify people with MCCs into more consistent subpopulations based on care needs or risks, thus achieving some minimal congruence in the definition of MCCs across studies.

Furthermore, NP roles and responsibilities in primary care were not uniform across studies included in our review. For example, we discuss telehealth visits conducted by sole NP providers alongside care delivered in-person by an NP-led interdisciplinary team. In studies where NP primary care was supported by other clinicians (e.g., RN care managers and social workers), the team compositions also differed across studies. Thus, differences in NP primary care across studies represent a limitation of our synthesis.

In addition, non-U.S. populations were systematically missed by this review. The United States has a unique health system, and so we opted to review this evidence separately to support specific research, policy, and practice recommendations. However, NP care of people with MCCs is an important global topic that should be addressed in future reviews.

Finally, pediatric populations were systematically excluded in this review. We excluded pediatric populations as they have unique developmental needs in primary care. However, MCC is increasingly an issue across the lifespan, and therefore, NP care outcomes for pediatric patients with MCCs should also be addressed in a future review.

Conclusion

This systematic review is the first to study structures, processes, and outcomes of NP care for patients with MCCs. NP primary care that engages an interdisciplinary team, mobilizes technology, and connects patients with community resources may be the future of MCC care. Although more research is needed, the existing body of literature suggests that primary care models involving NPs are effective at delivering cost-effective primary care that aligns with guidelines, supports patient self-management, and contributes to similar hospitalization and ED use outcomes compared with primary care models without NPs. We found no evidence that NP involvement in care contributes to worse outcomes for patients with MCCs. Based on the available evidence, we conclude that NP-delivered primary care has a similar or positive impact on MCC patient outcomes in comparison with primary care models that do not involve NPs, such as those only utilizing physicians and PAs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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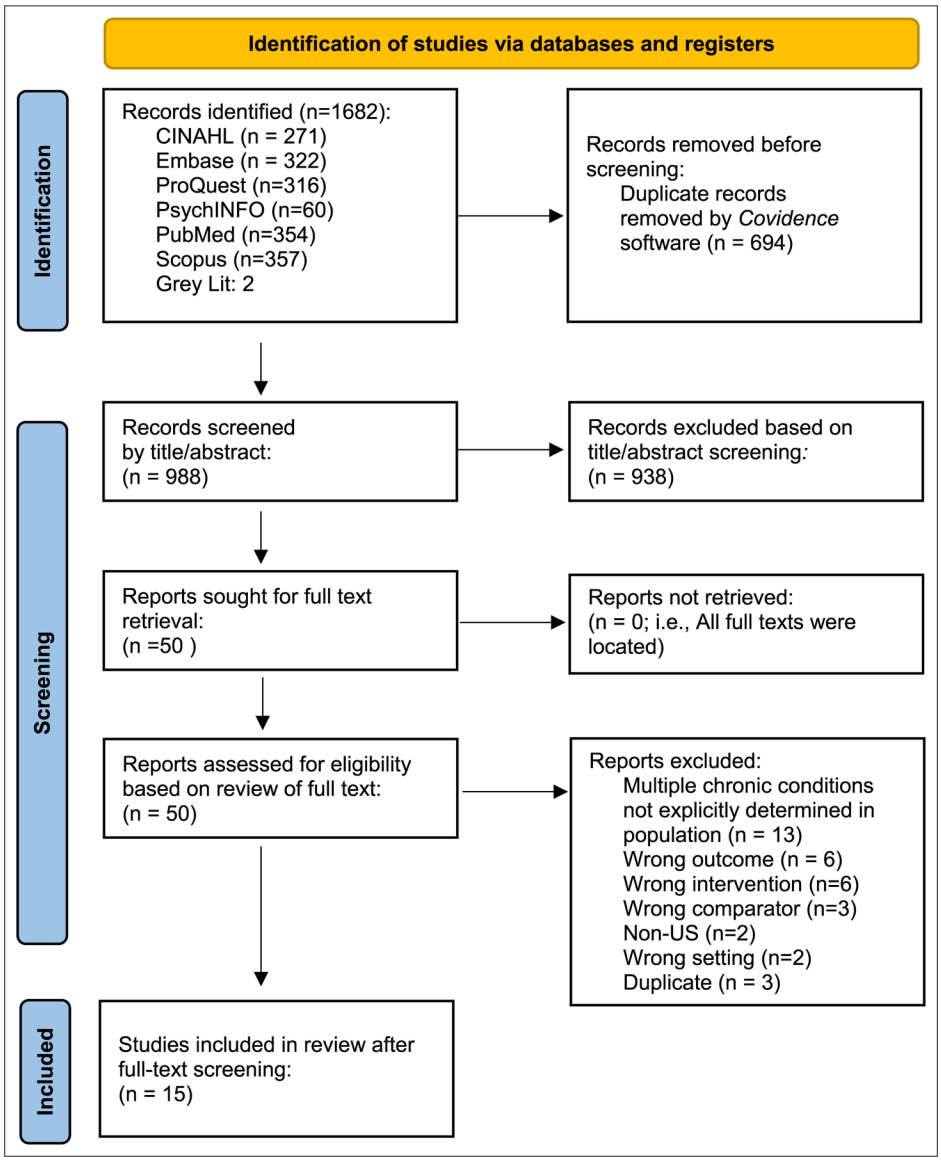

Figure 1.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Diagram. *Note*. The term “record” refers to the title or abstract (or both) of a report indexed in a database. The term “report” refers to a document supplying information about a particular study. The term “study” refers to an investigation that includes a defined group of participants and one or more interventions and/or outcomes, from Page et al. (2021b).

Table 1.

Description and Results of Reviewed Studies (n = 15).

Reference	Design and quality rating	Sample (n; % largest group)	Data source or setting	Aim	Relevant outcomes
Chou etal. (2021)	Cross-sectional design; low risk of bias (score: 0.88)	*n* = 615,395 patients aged ≥66; 28.4% 70–74 years; 60.5% female; 78.3% White; 76% metropolitan	Medicare (Texas; 2015–2016)	To assess odds of PIM prescribing (per Beers Criteria) by NPs compared with physicians.	When the provider was an NP, patients with 0–1 chronic conditions saw a 38% decrease in the odds of PIM prescription compared with when the provider was a physician (OR = 0.62; CI = [0.53, 0.73]), whereas patients with >5 chronic conditions saw a 52% decrease in the odds of PIM prescription (OR = 0.48; CI = [0.44, 0.53]).
Christianson-Silva etal. (2021)	Quasi-experimental design; high risk of bias (score: 0.44)	*n* = 61 patient visits (36 ED visits and 25 hospital stays); P.367: "… mainly low income with multiple complex chronic diseases … many were of Hispanic/ Latino descent"; enrolled in Medicaid	Academic medical center (Arizona)	To assess outcomes associated with an NP-led interprofessional "AEIO0U bundle" intervention (Access to team-based care; Essential initial assessment;/dentification of gaps in care; *0* days without medications; Occasions for engaging support people; Utilization of available resources) compared with baseline data.	Fewer ED and hospital visits were observed in participants 6 months after initiation of the program compared with 6 months before initiation of the program (ED: 60 visits vs. 41 visits, 58.3% reduction; hospital: 37 stays vs. 24 stays, 35.3% reduction). Lower adjusted total charges (ED: US$36,482 vs. US$21,678, 40.6% reduction; hospital: US$456,626 vs. US$226,873, 50.3% reduction).
Druss et al. (2017)	RCT design; high risk of bias (score: 0.46)	n = 447 patients with serious mental illness (schizoaffective, bipolar, major depression, obsessive-compulsive or posttraumatic stress disorder, or schizophrenia) and ≥ 1 of blood pressure: > 130/85, fasting glucose: > 100, LDL: ≥ 160; mean age: 47.26, 64% female, 54% White	Partnership between a community mental health center and a FQHC (Georgia[a])	To compare quality and outcomes of care between an integrated behavioral health home (where patients received primary care from an NP) and usual care.	Patients receiving integrated behavioral health received more preventive and guideline-concordant cardiometabolic services overall (intervention: 14% more services at 12 months vs. usual care: 2% fewer, $p < .001$; Cohen's $d = 0.7$). Diabetes services (intervention: 25% more vs. usual care: 3%, $p < .001$); HTN services (intervention: 13% more vs. usual care: 5% less, $p < .001$); no difference in hyperlipidemia services (intervention: 34% more vs. usual care: 19% more, $p = .062$). Primary care visits increased 12 months after intervention (0.8 vs. 0.21, $p < .001$). No other changes in service utilization were significant (including ED visits and hospitalizations). No significant changes to PAM. Most clinical outcomes showed no statistically significant improvement (diastolic blood pressure, total and LDL cholesterol levels, blood glucose level, HbA1c level, Framingham risk score, and the physical component of the SF-36). However, modest differences were observed in the mental component of the SF-36 survey (intervention: 8.1 vs. usual care: 7, $p = .029$) and SBP (intervention: 4.9 mmHg reduction vs. usual care: 3.1 mmHg reduction, $p = .045$).
Fraze et al. (2020)	Cross-sectional design; low risk of bias (score: 0.88)	*n* = 23,502,189 patients. Mean age: 71.7, mean number of HCCs: 1.5, 56.2% female, 82.7% White, non-Hispanic, 75% from metropolitan practices	Medicare (United States or Washington DC, 2012–2017)	To estimate trends in the percentage of Medicare beneficiaries cared for by NPs compared with physicians, to characterize beneficiaries cared for by NPs compared with physicians, and to compare service use and costs between beneficiaries cared for by NPs and those cared for by physicians.	Among beneficiaries cared for by NPs in 2017, 25.9% had three or more chronic conditions compared with 20.8% of those cared for by physicians. No differences in ED visits and hospitalizations more than 1 year. Mean total costs were slightly higher for patients cared for by NPs (US$ 10,644 [NPs] vs. US$ 10,145 [MD]) more than 1 year.
Garfein et al. (2021)	Cohort design; low risk of bias (score: 0.73)	*n* = 4,559 patients. Mean age: 66.1, 58.9% male, 85.4% White, mean CCI score: 5.81	Academic medical center (Michigan)	To evaluate the effectiveness of an NP-led transitional care program ("Bridging the Discharge Gap	NP-led transitional care program for patients discharged from hospital with cardiac conditions was only inversely associated with hospital readmission in patients with low CCI (adjusted

Reference	Design and quality rating	Sample (n; % largest group)	Data source or setting	Aim	Relevant outcomes
				Effectively" [BRIDGE]) at mitigating adverse clinical outcomes in cardiac patients with varying CCI, compared with baseline data.	HR = 0.82, 95% CI = [0.69, 0.97], p = .02) but not in patients with high CCI (adjusted HR = 0.94, 95% CI = [0.82, 1.07], p = .35).
Hummel et al. (2017)	Quasi-experimental design; moderate risk of bias (score: 0.55)	n = 82 patients with the top 5% total health care costs and the top 5% CAN score at facility. Mean age: 76, 100% male, 53% White, Mean CAN score: 97, mean number of chronic conditions: 12	VHA (California)	To evaluate the effect of an NP-led intensive outpatient program on end-of-life care. NPs provided clinical case management, coordination of services with patients' providers, and assessment of patient goals and preferences, in addition to interdisciplinary services such as coattendance at medical appointments and referral to community services, compared with usual care.	Patients receiving the intervention had higher rates of hospice referral compared with patients enrolled in usual primary care (intervention: 74% [n = 14] vs. usual care: 44% [n = 28], χ^2 = 4.995, p = .025).
Kobb et al. (2003)	Quasi-experimental design; low risk of bias (score: 0.77)	n = 281 patients with high-cost medical care needs (≥US$25,000) and high-use (two or more hospital admissions, frequent emergency room visits, and unscheduled walk-in visits, and 10 or more prescriptions) in the year preceding enrollment. Mean age: 70, 98% male, 65% White	VHA (Florida and Puerto Rico)	To evaluate whether care coordination by NP and social worker teams plus the addition of telehealth services could improve service use and functional status among rural veterans compared with usual care.	Patients in the intervention group had 60% fewer hospitalizations, and 66% fewer ED visits, and 4% fewer clinic visits at 12 months compared with baseline. In contrast, usual care participants had 27% more hospitalizations, 22% more ED visits, and 19% more clinic visits at 12 months compared with baseline data. Functional status improved from baseline in terms of general health, mental health, social functioning, physical role, and physical functioning but showed little change in terms of bodily pain, vitality, and emotional role (exact numbers not provided).
Lenaghan (2019)	Quasi-experimental design; moderate risk of bias (score: 0.55)	n = 25 patients aged ≥65. Mean age: 79.32, 68% female, 94% White	Phone coaching and home visits within community (New Jersey[a])	To evaluate whether an NP-led transitional care intervention postdischarge (from a subacute care facility) involving phone calls, home visits, and health coaching could improve patient empowerment as measured by the SEAPS survey compared with pre-intervention scores.	Patient empowerment scores improved following the NP intervention compared with pre-intervention scores, self-efficacy subscale of the SEAPS survey, t (24) = 3.612, p = .001; belief subscale, t (24) = 6.058, p < .001.
Litaker et al. (2003)	RCT design; high risk of bias (score: 0.46)	n = 157 patients with HTN and diabetes.	Academic medical center (Ohio)	To compare NP-physician teams (supported by clinical practice algorithms and flowcharts) with physician-only usual care in terms of chronic disease outcomes and costs.	Patients in the intervention group received more education on medication side effects (intervention group: 100% vs. usual care: 38%, $p \leq .001$). Documentation of some preventive care was higher in the intervention group (vaccination: 62% intervention group; 37% usual care group, p < .001; foot examination: 79% intervention group, 28% usual care group, p < .001). Greater mean change in HbA_{1c} from baseline in team-treated patients, team: −0.63 (SD = 1.5), usual care = −0.15 (SD = 1.0), p = .02, and HDL, team = 3.0 (SD = 7.2), usual care = 0.4 (SD = 6.6), p = .02. No change in total cholesterol, team = −10.8 (SD = 33.6), usual = −9.89 (SD = 27.9), p = .85; BP (team = 11, usual care = 10, p = .83); physical component of health-related QOL, team = 0.50 (SD = 8.74), usual = −1.27 (SD = 7.94), p = .19; or mental component, team = 3.27 (SD = 10.0), usual = 1.13 (SD = 9.1), p = .17. Increased personnel costs for 12-month patient management (team = US$134.68

Reference	Design and quality rating	Sample (n; % largest group)	Data source or setting	Aim	Relevant outcomes
					[*SD* = US$58], usual care = US$93.70 [*SD* = US$61], *p* < .001)
Mailliard et al. (2019)	Quasi-experimental design; high risk of bias (score: 0.33)	*n* = 76 patients. Mean age: 79.1, average: 13.7 medications, took medications mean of 2.8 times a day	Primary care geriatric clinic (Illinois[a])	To evaluate the use of a primary care geriatrician referral to an NP intervention involving a brown bag medication review, assessment of patient's ability to manage medications, assessment for medication-related problems (e.g., discrepancies, high-risk medications, and inappropriate medications), and targeted changes to improve the safety of the medication regimen. No comparator.	Medication discrepancies were found for 77% of patients, with a median of 2.5 discrepancies per patient. APNs found that the medication regimen could be simplified in 76% of patients, and they made changes to patients' medication regimens in 98% of visits.
Mallow et al. (2018)	Quasi-experimental design; moderate risk of bias (score: 0.55)	*n* = 30 patients aged > 18. Mean age: 52, mean number of chronic conditions: 4, 70% female, 70% White	Web-based rural health setting (West Virginia)	To evaluate the effect of a web-based, structure of sensors and mobile devices developed, implemented, and evaluated by NPs, in terms of clinical outcomes, loneliness, and HRQOL, compared with baseline measurements.	After the 12-week intervention, mean random glucose significantly decreased (*M* = 146.79, *SD* = 60.68, *p* = .000). There were reductions in systolic blood pressure (*M* = 118.93, *SD* = 12.5, *p* = .000), diastolic blood pressure (*M* = 83.62, *SD* = 8.07, *p* = .000), and BMI (*M* = 35.05, *SD* = 4.39, *p* = .04). Mean weight decrease was not statistically significant. There were no significant changes to loneliness, HRQOL, or depression scores.
Morgan et al. (2019)	Cohort design; low risk of bias (score: 0.90)	*n* = 47,236 patients with diabetes and other comorbidities; mean age: 65.3, 95.4% male, 71.3% White, mean chronic conditions: 6.7, mean DCG score: 3.5	VHA (national, 2012–2013)	To compare health service use and costs when the primary care provider was an NP compared with when they were a physician or PA.	NPs' patients incurred 6% lower expenditures compared with those of physicians (95% CI = [3, 9], *p* < .001). NPs' patients were less likely than those of physicians to incur a hospitalization (NP vs. physician odds ratio: 0.89, 95% CI = [0.85, 0.94]). Patients of NPs were also less likely than those of physicians to incur a hospitalization related to an ambulatory care-sensitive condition (NP vs. physician OR: 0.90, 95% CI = [0.86, 0.96]). Patients of physicians also visited the ED more frequently in the year than patients of NPs (NPs vs. physician rate ratio: 0.90, 95% CI = [0.87, 0.94]). No difference between NP and physician primary care visits.
Sharma et al. (2013)	Quasi-experimental design; moderate risk of bias (score: 0.55)	*n* = 481 patients with diabetes and cancer.	900-bed community hospital (Pennsylvania)	To evaluate the effect of integrated diabetes/oncology care, including medical co-management by NPs, enhanced care coordination, and collaborative care planning, on service use, patient satisfaction (Primary Care Assessment Survey), and patient empowerment (Diabetes Empowerment Scale) compared with a group of patients from the prior year who had similar characteristics.	The intervention group showed a 3.4% reduction in potentially avoidable ED visits, observation, or hospital admissions versus a comparison group from the prior year. Mean patient satisfaction increased (preprogram: 79.74 [*SD* = 20.41] vs. postprogram: 86.00 [*SD* = 17.71]; no p value). Mean patient empowerment increased (preprogram: 4.04 [*SD* = 0.73] vs. postprogram: 4.59 [*SD* = 0.63]; no *p* value).
Talley etal. (2021)	Quasi-experimental design; low risk of bias (score: 0.77)	*n* = 520 patients being treated for heart failure or diabetes who also have mental health or substance use disorder. Average age: 42.4–46.5 years, 48.7%-75% male,	Nurse-led HRTSA and PATH clinics (Alabama)	To examine the effect of integrating behavioral health within PATH and HRTSA clinics (including a psychiatric mental health NP, psychiatrist, clinical social worker, and care coordinator) among patient with	Improvement on measures of depression was observed across most groups regardless of level of engagement (PATH clinic: highly engaged patients: 5.4 point improvement in PHQ-9 score [*p* < .001]; disengaged patients: 3.4 point improvement [*p* < .001]; HRTSA clinic: highly engaged patients 4.4 point improvement [*p* < .001]; disengaged patients: 6.0 point

Reference	Design and quality rating	Sample (n; % largest group)	Data source or setting	Aim	Relevant outcomes
		91.996–96.4% non-Hispanic, 49.6%-84.6% Black.		varying levels of engagement (defined by attendance at appointments) in terms of depression (PHQ-9 score), anxiety (GAD-7 score), SI, substance use, and tobacco use, compared with baseline measurements.	improvement [$p < .001$]). Improvements in measures of anxiety were only seen among highly engaged patients at the PATH clinic (5.0 point improvement in GAD-7 score [$p < .001$]). No change observed in tobacco or substance use except among highly engaged patients at the HRTSA clinic (pre-intervention: 43.5% no tobacco use vs. post-intervention: 62.6% no tobacco use [$p = .033$]; pre-intervention: 64.9% no substance use vs. post-intervention: 71.8% no substance use [$p = .029$]). At the HRTSA clinic, changes in suicidal ideation were only seen at the among disengaged patients (pre-intervention: 63.9% denied SI vs. post-intervention: 91.2% denied SI [$p = .003$]). At the PATH clinic, reductions in SI were seen across most groups regardless of level of engagement, with most pronounced improvement was among highly engaged patients (pre-intervention: 55.5% no SI, vs. post-intervention: 77.8% no SI [$p < .001$])
Zulman et al. (2017)	RCT design; high risk of bias (score: 0.46)	$n = 583$ patients. Mean age: 66 years; 90% male, mean number of chronic conditions: 10	VHA (California)	To evaluate the impact of an intensive outpatient program ("Intensive Management Patient Aligned Care Team" [ImPACT]) involving a multidisciplinary team (NP, physician, social worker, recreational therapist) providing comprehensive patient assessment, goal-setting social support, and care management, in terms of cost, service use, and mortality, compared with baseline measurements.	No difference in total health care costs, service utilization, or mortality.

Note. NP = nurse practitioner; PA = physician assistant; OR = odds ratio; CI = confidence interval; MD = medical doctor; RCT = randomized controlled trial; PCP = primary care provider; FQHC = Federally Qualified Health Center; HTN = hypertension; PAM = patient activation measure; SF-36 = 36-item Short-Form Health Survey; SBP = systolic blood pressure; *SD* = standard deviation; PHQ-9 = Patient Health Questionnaire–9; GAD-7 = Generalized Anxiety Disorder–7; PATH = Providing Access to Healthcare; HRTSA = Heart Failure Transitional Care Services for Adults; LDL = low-density lipoprotein cholesterol; HDL = high-density lipoprotein cholesterol; HCC = hierarchical condition categories; CCI = Charlson Comorbidity Index; CAN = care assessment needs; VHA = Veterans Health Administration; SEAPS = Senior Empowerment and Advocacy in Patient Safety survey; QOL = quality of life; APN = advanced practice nurse; HRQOL = health-related quality of life; HbA_{1C} = glycated hemoglobin test; DCG = diagnostic cost group; PIM = potentially inappropriate medication; SEAPS = Senior Empowerment and Patient Safety; BMI = body mass index.

[a] Primary author's location.