

# The Impact of Using Mid-level Providers in Face-to-Face Primary Care on Health Care Utilization

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**Background:** There has been concern that greater use of nurse practitioners (NP) and physician assistants (PA) in face-to-face primary care may increase utilization and spending.

**Objective:** To evaluate a natural experiment within Kaiser Permanente in Georgia in the use of NP/PA in primary care.

**Study Design:** From 2006 through early 2008 (the preperiod), each NP or PA was paired with a physician to manage a patient panel. In early 2008, NPs and PAs were removed from all face-to-face primary care. Using the 2006–2010 data, we applied a difference-in-differences analytic approach at the clinic level due to patient triage between a NP/PA and a physician. Clinics were classified into 3 different groups based on the percentage of visits by NP/PA during the preperiod: high (over 20% in-person primary care visits attended by NP/PAs), medium (5%–20%), and low (<5%) NP/PA model clinics.

**Measures:** Referrals to specialist physicians; emergency department visits and inpatient admissions; and advanced diagnostic imaging services.

**Results:** Compared with the low NP/PA model, the high NP/PA model and the medium NP/PA model were associated with 4.9% and 5.1% fewer specialist referrals, respectively ( $P < 0.05$  for both estimates); the high NP/PA model and the medium NP/PA model also showed fewer hospitalizations and emergency department visits and fewer advanced diagnostic imaging services, but none of these was statistically significant.

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**Conclusions:** We find no evidence to support concerns that under a physician's supervision, NPs and PAs increase utilization and spending.

**Key Words:** primary care, nurse practitioner, physician assistant, healthcare utilization

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The aging population and expansions in insurance coverage from the Affordable Care Act are exacerbating the shortage of primary care physicians in the United States.<sup>1</sup> Increasing the number of nurse practitioners (NPs) and physician assistants (PAs) working in primary care has been proposed as part of a national strategy to overcome this potential shortfall.<sup>2–4</sup>

Although prior studies have documented that the quality of care provided by NPs is comparable to that of physicians,<sup>5–7</sup> there is concern that they may increase utilization and spending.<sup>8</sup> The clinical training models for NPs and PAs are different in important ways from that for physicians,<sup>9</sup> which could translate into less comfort in managing specific conditions or patients with multimorbid complex needs and therefore a lower threshold to obtain diagnostic imaging and make referrals to specialist physicians.

Evidence about the inclusion of PA/NPs in primary care on use of medical services in patient populations is minimal and mixed. Studies have found that compared with primary care physicians, NPs were more likely to order imaging tests in Medicare patients and showed higher utilization levels in veterans.<sup>10,11</sup> But a study comparing independently practicing NPs to primary care physicians did not demonstrate significant differences in utilization of primary care, specialty care, emergency care, or inpatient care.<sup>12</sup>

To address the question of what impact NPs and PAs have on utilization in a setting where physician-supervised NPs and PAs provide face-to-face primary care, we conducted a retrospective observational study of a unique natural experiment in Kaiser Permanente in Georgia to inform clinicians and policymakers.

## MATERIALS AND METHODS

### Setting

During the study period, from January 2006 to June 2010, Kaiser Permanente provided comprehensive medical

care to approximately 200,000 primary care patients per year in the greater Atlanta metropolitan area. Under the Kaiser model, primary care providers are responsible for coordinating the orders for specialty care or diagnostic imaging for their patients.

From 2006 through early 2008, in clinics with NPs and PAs, each NP or PA was paired with a physician to provide face-to-face primary care. NPs and PAs had similar scopes of practice in the clinics and physician supervision was comparable. Appointment scheduling was centralized and patients were generally triaged by the schedulers to a NP/PA or physician based on preexisting relationships with providers and appointment availability. Patients could also be triaged between a NP/PA and a physician at the time of care. NP/PAs were allowed to write prescription drugs and supervising physicians had to see the patients cared by NP/PAs quarterly and review all patient charts. Beyond face-to-face care, NP/PAs also conducted some patient panel management activities such as proactive outreach to patients and chronic disease management.

In early 2008, a change of the leadership led to a reconsideration of the risk and benefits of using NP/PAs in primary care due to administrative concerns such as the inflexibility of the centralized scheduling system to direct patients and the considerable amount of work required for physician supervision. As a result, Kaiser Permanente leadership removed all NP/PAs from face-to-face primary care in Georgia, adopted a physician-only model, and hired additional physicians to replace NP/PAs. During the transition period, some hospitalists were used to manage patient volume surge when needed. This policy change allowed us to evaluate the impact of NP/PA usage on health care utilization.

## Data

Clinical data were obtained from Kaiser Permanente's electronic medical records for the years 2006–2010 at the monthly level for the 10 clinics where care was provided for the entire study period. Several clinics opened after 2008 and were excluded from analysis due to a lack of preperiod data. Data collected include information on clinic identifiers, patient demographics, patient comorbidities, and health care utilization. We tracked monthly the number of primary care visits provided by NPs, PAs, and physicians, respectively. Using administrative data, we also tracked the number of hours in clinic by NP/PAs and physicians (we were not able to separate NP hours from PA hours due to data limitations).

## Key Outcomes

We focused on 3 types of utilization outcomes in the analysis [advanced diagnostic imaging, specialist referrals, and emergency department (ED) visit and hospital admissions], because they are common, relatively costly, and potentially related to a model of primary care delivery. In many cases, orders for advanced diagnostic imaging and specialist referrals occur on the discretion of the attending primary care provider, whereas ED visits or hospital admissions might occur due to the direction of a primary care provider or as a consequence of a clinical model of care in which primary

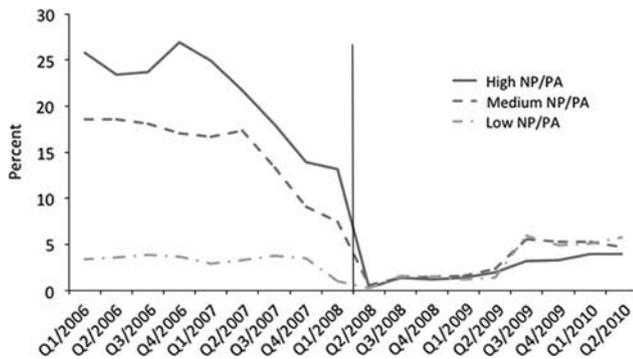
care differs between PA/NPs and physicians. For instance, if managing patients by physicians paired with mid-level providers leads to better patient outcomes than by physicians only, we would expect to see fewer ED visits and hospital admissions in clinics with more NP/PA usage. The total number of referrals was defined as those to cardiologists, endocrinologists, nephrologists, pulmonologists, and rheumatologists. Health care utilization includes ED visits and inpatient admissions. Advanced diagnostic imaging includes magnetic resonance imaging, computerized tomography, and nuclear scan. We tracked these outcomes monthly for each clinic. In the descriptive results, we present utilization rates per 10,000 patients for all 3 utilization outcomes, calculated as the total number of utilization events in a quarter divided by the average monthly patient panel size.

## Statistical Analysis

We applied a quasi-experimental study design by comparing the differences in utilizations before and after the 2008 change in staffing between clinics using a NP/PA model and those that did not. In the Kaiser clinics, NPs and PAs had similar scopes of practice and therefore we studied them together. Our analysis incorporated 2 features.

- (1) The analysis was conducted at the clinic level to address the concern that some pre-2008 patients may have been triaged between a NP/PA and a physician. If a physician is more likely to see sicker patients than a NP/PA and therefore must order more diagnostic imaging studies, an analysis conducted at the provider or patient level might generate biased results. In addition, at the time of care, the supervising physician may help a NP or PA with diagnosis or treatment decisions, and therefore it may not be appropriate to attribute a clinical decision purely to a NP or PA. Analysis at the clinic level can also capture panel management or other population-based activities provided by NP/PAs that would be difficult to directly attribute to a specific patient encounter.
- (2) We used a difference-in-differences model to tease out temporal trends in the utilization and control for the baseline values of outcomes (and consequentially the baseline values of influential covariates). As described in detail below as well as the appendix, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234> our model included several departures from the classic difference-in-differences formulation to account for the fact that the intervention occurred in the earlier period, monthly data were available for analysis, a handful of time-variant covariates that describe a clinic's patient population were available, and we aimed to control for unobserved time-invariant clinic characteristics using clinic level-fixed effects.

As managing a patient panel by NP/PAs and physicians existed in the earlier period only, the “intervention period” is the preperiod and the postperiod is the comparison period. As illustrated in Figure 1, most NP/PA activity, as measured by the percentage of primary care visits provided by NPs or PAs, occurred before the second quarter of 2008 although the activity started to level off in 2007. There was also a slight increase in NP/PA activity after the second



**FIGURE 1.** Percentage of primary care visits attended by NP/PAs, by primary care model, 2006–2010. Note: We defined the preperiod as the period between 2006 and the first quarter of 2008 (9 quarters in total) and the postperiod as the period between the second quarter of 2008 and the second quarter of 2010 (9 quarters in total). In the preperiod, on average, 21.3% of primary care visits in the high NP/PA clinics were attended by NP/PAs, 15.1% in the medium NP/PA clinics, and 3.2% in the low NP/PA clinics. NP indicates nurse practitioners; PA, physician assistants.

quarter of 2009, as a very limited number of NPs and PAs were rehired by a few clinics for specific activities in chronic care management.

We defined the preperiod as the period between January 2006 and March 2008 (27 mo in total) and the postperiod as the period between April 2008 and June 2010 (27 mo in total). Clinics were classified into 3 different groups based on the percentage of visits by NP/PA during the preperiod: high NP/PA model clinics (over 20% in-person primary care visits attended by NP/PAs on average), medium NP/PA model clinics (5%–20% visits attended by NP/PAs), and low NP/PA model clinics (an average of <5% visits attended by NP/PAs). We classified the clinics into the 3 groups because it naturally fit the range of NP/PA usage at the 10 clinics and it also allowed us to test if there was a “dose response” from different levels of use of NP/PAs on utilization. The expectation for the dose response would be that any impact would be greater in high NP/PA model clinics compared with medium NP/PA model clinics.

We used a difference-in-differences model to assess the impact of the change in NP/PA usage. Specifically, we compared the changes in utilization in the high (or medium) NP/PA clinics before and after the removal of NP/PA from in-person primary care to the changes in the low NP/PA clinics. We used a negative binomial model for each of the 3 types of utilization because utilization events are count variables and because a Poisson model appeared to be overdispersed based on a goodness-of-fit test. The dependent variable is the monthly count of utilization events for each clinic and the independent variables included patient panel size (as the exposure variable in the negative binomial model), NP/PA model indicator, an interaction term between the preperiod and the care model indicator, a set of fixed effects for clinics to control for differences in utilization between clinics at baseline, a set of fixed effects for calendar quarters to control for temporal trends, percentage of female

patients, percentage of patients over 60 years, and percentage of patients with diabetes. We had to be judicious in the number of patient level characteristics that were added to the model as covariates as our sample size is relatively small. Given that we use a difference-in-differences approach, it is only necessary to use such covariates if they observe rates of change (from the preperiod to the postperiod) that are different for the 2 groups being compared, and therefore we included in the model only the patient-level characteristics that had patterns of change that were differentiated across the 2 groups. Standard indicators for treatment versus control and preperiods versus postperiods in a typical difference-in-differences model are not needed because they would be absorbed by the more granular indicators.

The results are presented as the hypothetical percent change in utilization during the preperiod that would be observed if a low NP/PA usage clinic had instead been a high (or medium) NP/PA usage clinic, after controlling for the aforementioned covariates. More details on the statistical model and marginal effect calculations are provided in the Appendix, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>.

Several sensitivity analyses were conducted to test the robustness of our results (results in the Appendix, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>). First, because NP/PAs performed functions beyond face-to-face visits that might impact our outcomes, we classified clinics into 3 groups using the proportion of primary care staff hours provided by NPs and PAs in each clinic. We chose to focus on percentage of visits cared for by NP/PAs as the main analysis, because we felt the decision to refer, order an imaging test, send a patient to the ED was more likely to be triggered by a visit than chronic disease management. Second, to disentangle the effect of NP from that of PA, we classified clinics into the 3 groups based only on percentage of primary care visits attended by NPs (such detailed data on staff hours were not available) and controlled for percentage of visits attended by PAs in the regression models. Moreover, we redefined the preperiod as 2006 through the first quarter of 2007 because there appears to be a transition period where NP/PA activity at clinics began to decline after the first quarter of 2007. Lastly, we did not group clinics based on NP/PA visit rates. Rather, the key predictor variable in our models is the percentage of visits provided by NP/PAs in a given month at a clinic, a continuous variable. Such an approach allows us to exploit month-to-month variation in the use of NPs/PAs. More details on this model are provided in the Appendix, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>.

## RESULTS

During the preperiod, 3 clinics used a high NP/PA model, 4 clinics used a medium NP/PA model, and 3 used a low NP/PA model. The average number of patients served by the 10 clinics decreased slightly from the preperiod to the postperiod, and the decline in the patient population size was similar across all 3 groups of clinics (Table 1). Compared with the clinics using a low NP/PA model, clinics using a

high NP/PA model or a medium NP/PA model had a larger clinic patient population, more patients 17 years or younger, more patients with asthma, fewer patients with diabetes, hypertension, or cancer. But the differences are small. In the preperiod, high and medium NP/PA clinics had more NP/PAs and a larger patient panel per physician than low NP/PA clinics, but such differences almost disappeared in the postperiod. The number of patient visits per physician per day was slightly smaller in high and medium NP/PA clinics than low NP/PA clinics in the preperiod but slightly larger in the postperiod.

Over the course of the study period, across the entire study population, specialist referrals, hospital and emergency care utilization, and advanced diagnostic imaging increased by about 45%, 15%, and 70%, respectively (Fig. 2). On average, there were differences in utilization levels across the 3 groups of clinics; medium NP/PA model clinics had the highest utilization and high NP/PA model clinics had the lowest utilization.

On the basis of a difference-in-differences analytic approach, we present the findings as the hypothetical percent change in utilization during the preperiod that would be observed if a low NP/PA usage clinic had instead been a high (or medium) NP/PA usage clinic. We found that, compared with the low NP/PA model, the high NP/PA model was associated with 4.9% fewer specialist referrals ( $P < 0.05$ , Fig. 3). This was due to fewer referrals to nephrologists, pulmonologists, and rheumatologists, partly offset by more endocrinologist referrals (data not shown). Similarly, the medium NP/PA model showed 5.1% fewer specialist referrals than the low NP/PA model ( $P < 0.05$ ).

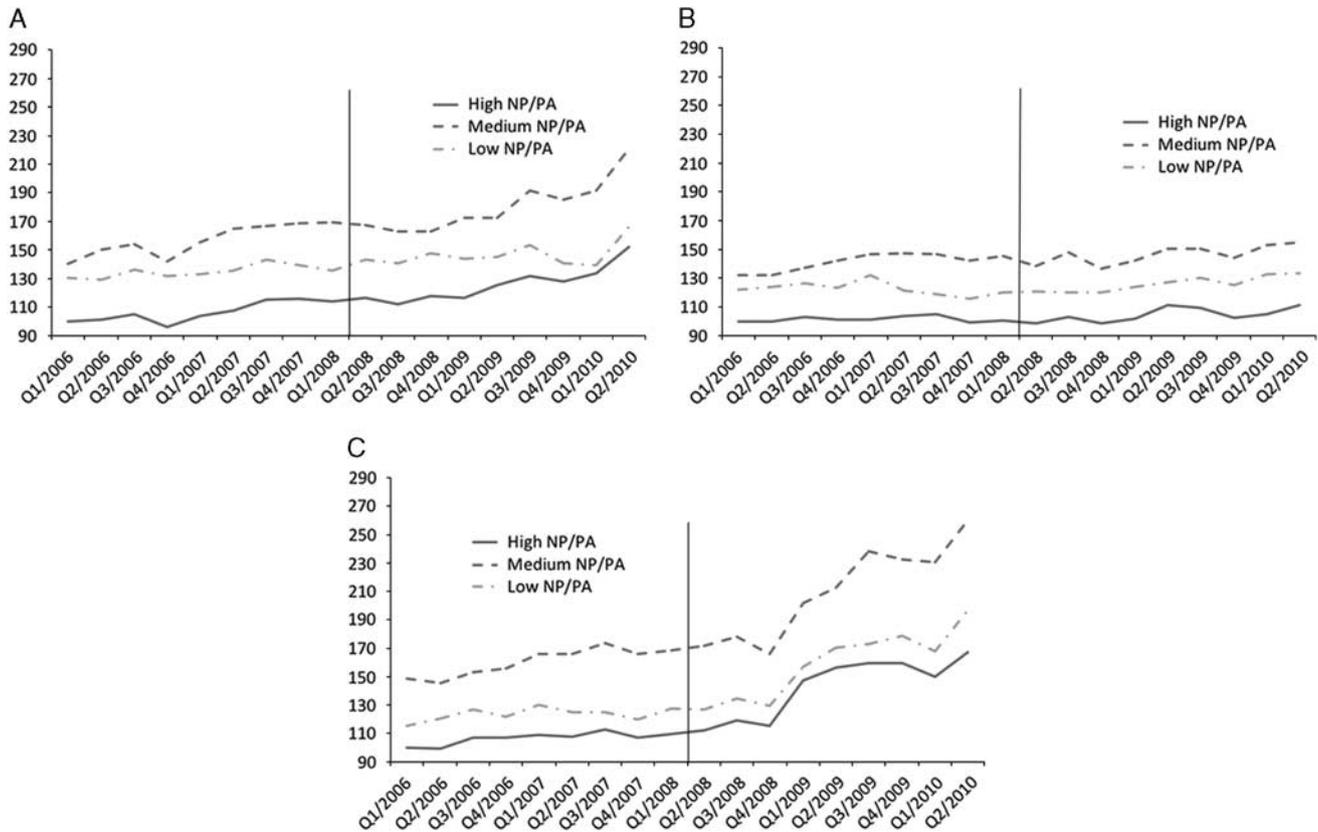
Compared with the low NP/PA model, the high NP/PA model and medium NP/PA models were associated with 2.0% ( $P > 0.05$ ) and 0.8% ( $P > 0.05$ ) fewer hospitalizations and ED visits, respectively. Neither difference was statistically significant. Similarly, only nonstatistically significant decreases were observed in advanced diagnostic imaging (Fig. 3). Compared with the low NP/PA model, the high NP/PA model and the medium NP/PA model were associated with 3.7% ( $P > 0.05$ ) and 0.4% fewer advanced diagnostic imaging services ( $P > 0.05$ ), respectively. The high NP/PA model was associated with a 7.9% lower use of magnetic resonance imaging ( $P < 0.05$ ) and a nonstatistically significant difference in nuclear scans (data not shown).

In the first sensitivity analysis, we used administrative data, specifically percentage of staff hours provided by NP/PA, to classify clinics (Appendix Figure A1, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>). Compared with low NP/PA model clinics, medium and high NP/PA model clinics had significantly lower levels of events in all 3 utilization types with much larger effect sizes than those in the main analysis (Appendix Figure A2, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>). In the second, we used the percentage of visits cared for by NPs (rather than combining NPs and PAs as in the main analysis). The trends were similar though the effect sizes more than doubled in some instances (Appendix Figure A3, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>). In the third sensitivity analysis, we removed the transition

TABLE 1. Characteristics of Clinics, by Primary Care Model

Characteristic	Clinics Using a High NP/PA Model (N = 3)		Clinics Using a Medium NP/PA Model (N = 4)		Clinics Using a Low NP/PA Model (N = 3)	
	Pre	Post	Pre	Post	Pre	Post
Clinic patient population size, average	32,095	25,996	23,289	20,572	15,993	13,929
No. physician FTEs, average	8.0	8.9	5.8	7.1	4.8	5.0
No. NP/PA FTEs, average	2.2	0.1	1.1	0.1	0.5	0.1
No. patients per physician FTE, average	4012	2921	4015	2897	3332	2786
No. face-to-face visits per physician per day, average	17.3	18.5	17.5	19.0	18.2	17.7
Patient age, median	36.9	38.3	36.9	38.5	36.3	38.0
Patients 17 or younger (%)	24.4	23.3	24.3	23.2	22.9	21.4
Patients 60 or older (%)	9.7	11.3	11.7	13.7	11.3	13.0
Female patients (%)	53.3	53.6	52.9	53.2	53.4	53.2
Patients with asthma (%)	8.9	9.6	8.7	9.5	8.6	8.8
Patients with diabetes (%)	6.5	7.3	6.0	7.0	7.1	8.0
Patients with hypertension (%)	24.1	28.3	23.7	28.1	25.4	29.7
Patients with hyperlipidemia (%)	16.9	20.1	16.9	21.0	18.4	21.3
Patients with cancer (%)	1.6	2.0	1.8	2.3	1.9	2.4
Patients with cardiovascular disease (%)	3.6	4.1	4.1	4.9	4.6	5.3

Note: Number of FTEs was computed based on the amount of time spent by physicians on patient care activities such as face-to-face visits and chart review, excluding paid time off and time spent on administrative duty. Number of face-to-face visits per day reflects the service volume per 8 hours spent on patient care activities. FTE indicates full time equivalents; NP, nurse practitioners; PA, physician assistants.



**FIGURE 2.** A, Number of specialist referrals per 10,000 patients per quarter (unadjusted, rebased to 100), by primary care model, 2006–2010. B, Number of hospitalizations and emergency department visits per 10,000 patients per quarter (unadjusted, rebased to 100), by primary care model, 2006–2010. C, Number of advanced diagnostic imaging tests per 10,000 patients per quarter (unadjusted, rebased to 100), by primary care model, 2006–2010. Note: We defined the preperiod as the period between 2006 and the first quarter of 2008 (9 quarters in total) and the postperiod as the period between the second quarter of 2008 and the second quarter of 2010 (9 quarters in total). Utilization rates per 10,000 patients (unadjusted) were calculated as the total number of utilization events in a quarter divided by the average monthly patient panel size. Since the actual rates are proprietary in nature, we rebased them to 100 using the first quarter of 2006 as the baseline period. NP indicates nurse practitioners; PA, physician assistants.

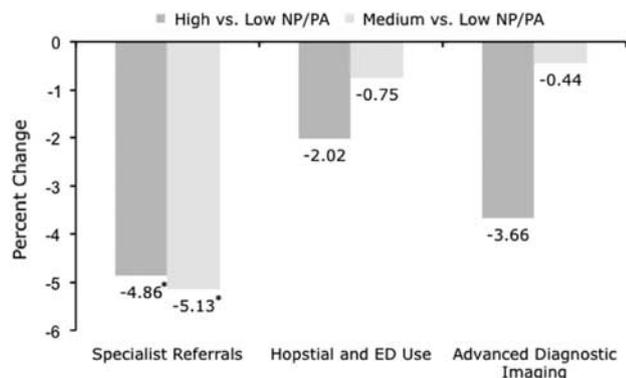
period from the preperiod and the results were similar (Appendix Figure A4, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>). Finally, instead of classifying the clinics into 3 groups, we used percentage of visits provided by NP/PAs as a continuous predictor of the outcomes. Compared with the main analysis, the magnitude of the change was similar, and for 2 outcomes, specialty referrals and use of hospitalization and ED visit use, the differences were statistically significant ( $P < 0.05$ ) (Appendix Figure A5, Supplemental Digital Content 1, <http://links.lww.com/MLR/B234>).

## DISCUSSION

In this study of a natural experiment in the use of NP/PAs in primary care clinics at Kaiser Permanente in Georgia, we found that the use of mid-level providers alongside physicians was not associated with higher use of specialty referrals, advanced diagnostic imaging, ED visit, or inpatient stays. On the contrary, most of our evidence suggests that

greater use of NP/PAs in primary care was associated with lower utilization. This does not support concerns that the increased use of NP/PAs in primary care will necessarily lead to increased health care utilization and spending in a setting where NP/PAs work alongside a physician.

But it is not clear from our results whether greater use of NP/PAs actually decreases utilization. Across most of our analyses, greater use of NP/PAs was associated with lower utilization and in some of our sensitivity analyses, the magnitude of the lower utilization doubled or even tripled. However, these differences were not always statistically significant and the timing of the changes in utilization did not clearly correspond to the shifts in staffing of primary care providers. We also did not observe a dose response effect, meaning the estimated effect size of the high NP/PA model was not larger than that of the medium NP/PA model. Whether the decreases in utilization associated with greater use of NP/PAs are clinically significant was not assessed. The magnitude of the decrease is smaller than the differences in utilization between the groups of clinics. However, given



**FIGURE 3.** The estimated impact of greater use of nurse practitioners and physician assistants for face-to-face visits on 3 utilization measures. Note: Authors' analysis of Kaiser Permanente data. \* $P < 0.05$ . Estimates in the figure represent the percent change in utilization during the preperiod that would be observed if a low NP/PA usage clinic had instead been a high (or medium) NP/PA usage clinic, after controlling for patient panel size, temporal utilization trends, percentage of female patients, percentage of patients over 60 years, percentage of patients with diabetes, and time-invariant clinic level characteristics. ED indicates emergency department; NP, nurse practitioners; PA, physician assistants.

the high costs of specialty visits and advanced diagnostic imaging, a decrease of 2%–5% could have a notable impact on overall health care costs.

Different from prior studies where physician care was compared with independent NP care, our study examined the effect of NP/PAs practicing alongside physicians. That is, we estimated the incremental benefit of adding mid-level practitioners to existing physician clinics. A quasi-randomized study by Hemani et al<sup>11</sup> found that compared with physicians, independently practicing NPs led to higher utilizations in 10 of 17 measures and 3 of them were statistically significant. Munding et al<sup>12</sup> randomly assigned patients to physicians and independent NPs but did not find differences in health care utilization after 1 year, including primary care visits, specialist visits, ED visits, and hospitalizations. Hughes et al<sup>10</sup> examined Medicare claims data and showed that NP/PAs were more likely to order imaging studies compared with primary care physicians; but it is unclear whether NPs included in their analysis were practicing independently. It is possible that when NPs are practicing independently, they tend to have a lower threshold of ordering tests or making referrals than physicians but not when they practice alongside physicians. We believe our results may be the most relevant from a policy perspective given most NPs/PAs in primary care work together with physicians. We hope our study shifts focus from the common “doctors versus nurses” debate to optimal staffing models for multidisciplinary primary care.<sup>13</sup>

In a sensitivity analysis where we accounted for non-visit activities of NPs/PAs, we found that greater NP/PA use was associated with a more robust decrease in utilization, suggesting additional lower health care use and costs was potentially created. The care provided by the NPs and PAs

might focus more on key issues such as health education, counseling, and personal and family dynamics.<sup>14,15</sup>

### Study Limitations

Owing to the data limitations, our comparison strategy may underestimate the effect of using NP/PAs alongside physicians in a primary care setting, because the transition from high or medium NP/PA usage to low NP/PA usage was a gradual process and there was also a slight uptick in NP/PA usage during the postperiod. In addition, we may not fully control for clinics' self-selection into high or medium NP/PA usage due to unmeasured clinic characteristics. Because of our difference-in-differences approach, to bias the results, such characteristics had to differentially impact the clinics and changed at the time of the shift from NP/PA use to physician use; such a scenario is possible but likely rare. For example, effective clinic managers at high or medium happened to retire at the time of the policy change. Also, high NP/PA model clinics on average had larger patient populations than low NP/PA model clinics and at larger clinics it might be more convenient for patients to receive specialty care or imaging services due to collocation of such services. However, we did not find a significant correlation of collocation of specialty care and imaging services with NP/PA usage. Furthermore, we were not able to examine health care spending due to a lack of prices for a closed health care system like Kaiser. Because we studied the impact of NP/PAs working alongside physicians, our results do not address the impact on utilization of NPs practicing independently. Finally, our study population was limited to Kaiser Permanente enrollees in Georgia and the generalizability to other clinical settings, practice models, or geographic regions is unclear.

In summary, we found that greater use of NP/PAs in primary care visits in the Kaiser Permanente system in Georgia was not associated with higher specialty referrals, advanced imaging, ED visits, or inpatient stays. Using physician-supervised mid-level providers in face-to-face primary care may be a promising primary care delivery model from an efficiency standpoint.

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