Effects of nurse practitioners' full practice authority on long-term care services

My (Michelle) Tran[a,b,d,*], Brenda Gannon[a,b], Stephen Birch[b], Sara Markowitz[c]

[a]*Department of Health Services Research & Policy, Australian National University, Canberra, Australia*
[b]*School of Economics, University of Queensland, Brisbane, Australia*
[c]*CBEH, University of Queensland, Brisbane, Australia*
[d]*Emory University, Atlanta, US*

Abstract

Many U.S. states have granted nurse practitioners (NPs) the right to practice and prescribe drugs without physician oversight, increasing the number of independent primary care providers. While existing studies show that full practice authority (FPA) increases access to primary care, thereby reducing the use of hospital services, less is known about its impacts on long-term care services. Using the Health and Retirement Study (HRS), we examine whether granting NPs full practice authority affects long-term care utilization. Exploiting the staggered adoption of states' Scope-of-Practice laws during 1998-2018, we find that NP full practice authority has no significant impacts on nursing home use but individuals living in states with no practice restriction are less likely to use home care services. In FPA states, we find that individuals living in medically underserved areas experience a larger reduction in the use of long-term care services and inpatient care than the same individuals living in states with no primary care shortages. Regarding health outcomes, we find evidence that individuals living in states with FPA are less likely to report being in poor health and have fewer functional limitations. These findings indicate that granting NPs full practice authority does not have any negative health consequences. This is also suggestive evidence that FPA can help improve population health in medically underserved areas and achieve cost-saving through reductions in costlier services.

Keywords: Long-term care, scope of practice, difference-in-differences, HRS

*Corresponding author. Email: my.tran@anu.edu.au

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1. Introduction

The population of the United States of America (U.S) is ageing rapidly. In 2019, there were more than 54 million people aged 65 and older in the United States; and this population has grown by over a third during the past decade (US. Census Bureau, 2020). Meanwhile, it has been suggested that there is a marked shortage of healthcare professionals to meet the complex needs of this older population (Schreiber, 2018). The Bureau of Labour Statistics (BLS) projects that the healthcare workforce would grow 15 percent by 2029, adding 2.4 million new jobs (US. Bureau of Labor Statistics, 2019). However, the demand for workers is predicted to outpace its supply, resulting in a shortage of between 17,800 and 48,000 primary care physicians by 2034 (Association of American Medical Colleges, 2021). Therefore, securing an adequate health workforce is of utmost importance to address the health needs of the ageing population, as well as to improve the efficiency of the healthcare system (Heisler, 2013).

Building an adequate primary care workforce is challenging, and the number of initiatives included in the Affordable Care Act (ACA) reveals the lack of consensus on the best way to achieve it (Cunningham, 2013). Traditionally, physicians have been the main primary care providers. However, as more physicians choose to specialise (Dalen et al., 2017), non-physicians have been providing a greater share of primary care. In 2010, nurse practitioners (NPs) were the largest non-physician providers of primary care, with approximately 56,000 NPs working in primary care settings (Agency for Healthcare Research and Quality, 2011). Between 2005 and 2015, the number of NPs has grown 7.4% per year, while the number of physicians has grown at only 1.9% per year (Maier et al., 2016).

Therefore, granting NPs tights to practice as primary care providers can potentially support the growing demand for primary care and mitigate the shortages of primary care physicians (Federal Trade Commission, 2014). Moreover, NPs are also more likely than physicians to practice in rural areas, which can help close the gap in primary care (Barnes et al., 2018).

However, the degree to which NPs can practice as primary care providers is governed by state scope-of-practice (SOP) laws regulating types of services that NPs can perform and physician involvement in the practice. While physicians generally have no restrictions on their SOP, not all states allow NPs to practice to the full extent of their training, education, and experience. In some states, NPs require physician oversight to treat or prescribe medications to patients. These restrictions have become the source of controversy as it is argued that they may generate unnecessary barriers to practice, reduce access to care and restrict efficiencies in the health system (Adams and Markowitz, 2018). On the other hand, critics contend that quality of care may suffer under NPs' direction, citing NPs' shorter length of training and clinical experience required (American Medical Association, 2021). This debate has increasingly attracted the attention of policymakers and researchers, especially in the wake of the COVID-19 pandemic when many state governments across the country temporarily removed these legal barriers for NPs to support their healthcare system (Kleinpell et al., 2021).

Despite existing studies showing no evidence that the quality of care delivered by an NP is worse than a physician (Alexander and Schnell, 2019; Liu et al., 2020), restrictive SOP laws still exist in 23 states. As of 2021, 26 bills in 13 dif-

ferent states have been introduced regarding the NP SOP, but only three enacted (Scope of Practice Policy, 2021). A review of existing literature reveals that granting NPs independent practice authority is neither helpful nor harmful to public health (Adams and Markowitz, 2018). Allowing NPs to work independently has been shown to increase access to care (Traczynski and Udalova, 2018; Alexander and Schnell, 2019) and increase NP supply in medically underserved areas (Xue et al., 2018). Although research on the NP SOP is growing rapidly, less is known about the effect of allowing NPs to be primary care providers on the outcomes of the older population. The older population tends to have more complex care needs. In 2018, 69 percent of the Medicare beneficiaries had at least two chronic conditions (Centers for Medicare & Medicaid Services, 2018). Older adults with multiple chronic conditions are also more likely to transition into nursing homes (Chyr et al., 2020) or require home care services (Gerteis et al., 2014).

The implications of NPs having independent practice rights for long-term care utilisation are not immediately clear. Existing literature has shown that NP independence in both prescriptive and practice authority increases the frequency of routine check-ups and decreases emergency room visits by patients with ambulatory care sensitive conditions (Traczynski and Udalova, 2018). Therefore, NP independence may increase long-term care utilisation if inpatient care is substitutable for long-term care (Forder, 2009). On the other hand, a review of international studies on the role of NPs in geriatric primary care reveals that NPs have positive impacts on patients' clinical outcomes and functional status, which are important determinants of long-term care utilisation (Chavez et al., 2018). Traczynski and Udalova (2018) find that NP independence has positive impacts

on access to care and health outcomes, particularly in areas with fewer doctors. Therefore, it is expected that long-term care utilisation may decrease as a result of the improvements in health, particularly in medically underserved areas.

This paper contributes to the existing literature by examining the effects of granting NP independence to practice on the utilisation of long-term care services. To our knowledge, there has been no published paper examining this relationship so far. Our finding aims to fill the gap in the existing literature and inform the debate surrounding the movement to remove legal barriers for NPs. Using individual-level data from the Health and Retirement Survey (HRS) and a Difference-in-Difference (DiD) approach, we find that granting NPs full practice authority reduces the utilisation of home care and nursing homes, specifically in medically underserved areas. This reduction in long-term care utilisation is a result of better health status and better functional status. Overall, the results suggest that granting NPs full practice authority can help close the health gaps in the older population between medically underserved and non-underserved areas and achieve cost savings through reductions in the use of costlier services.

The structure of this paper is as follows. The next section briefly introduces the U.S. healthcare system and the related literature, while the third section describes the dataset used in the analysis. Section 4 explains the empirical framework used for identification. Section 5 reports the estimation results, and the paper ends with a discussion of the findings.

2. Background and related literature

Advanced practice registered nurses (APRNs) are registered nurses with specialised advanced degrees and training. APRNs include certified registered nurse anaesthetics, certified nurse midwives, clinical nurse specialists, and nurse practitioners. In 2019, approximately 80 percent of the APRNs in the United States were NPs (US. Bureau of Labor Statistics, 2019). NPs most commonly specialise in primary care settings, including general or family practice, adult practice, women's health, paediatric, and gerontology (American Association of Nurse Practitioners, 2021). NPs provide primary and preventative services, prescribe medications, diagnose and treat common minor illnesses and injuries. NPs play a critical role in geriatric care as they are trained to focus on health promotion advice, lifestyle counselling, educational programs, and the provision of early interventions to prevent exacerbation or complications for patients with multiple chronic conditions (Delamaire and Lafortune, 2010; Niezen and Mathijssen, 2014; Maier et al., 2016). NPs practice in various settings, such as community clinics, health centres, urgent care centres, hospitals, NP led-clinics, retail-based clinics, and walk-in clinics.

While the training requirements for NPs are similar across the country, states can set their own laws governing the scope of NPs' practice. These laws specify what services NPs can provide and the condition under which they may provide these services. States may require physician collaboration through a collaborative agreement detailing the rights and responsibilities between an NP and a physician, along with the requirements for physician consultations. In states with more restrictive SOP legislation, NPs are required to undergo career-long supervision,

delegation, or team management by other health providers in order to provide patient care. Such requirements can be expensive and time-consuming for NPs. Existing evidence shows that NPs report difficulties finding or affording physicians who are willing to supervise or collaborate; and it is not uncommon for NPs to move or stop practising when their physicians move, retire, or die (Westat, 2015). Therefore, removing these legal barriers can lower this administrative burden on NPs, thereby increasing the supply of primary care providers. Numerous studies have found that the supply of NPs is higher in states with the least restrictive SOP laws, with no significant impacts on the supply of physicians (Reagan and Salsberry, 2013; Traczynski and Udalova, 2018; Xue et al., 2018).

For patients, legislation restricting NP autonomy can limit patient access to care. Numerous studies have found that removing or relaxing physician oversight requirements is associated with the higher probability of prescription being filled (Spetz et al., 2013) and with an increase in office-based visits (Stange, 2014). Traczynski and Udalova (2018) find that NP independence in practice also increases routine check-ups, usual source of care, and the chance of getting an appointment when wanted. On the other hand, there is no evidence that FPA results in worse health outcomes for patients (Kleinpell et al., 2021; Kurtzman et al., 2017; Perloff et al., 2019; McMichael, 2021). Granting NPs independent prescriptive authority can improve mental health, particularly in populations that are underserved by physicians and among populations that have difficulty accessing physician-provided care (Alexander and Schnell, 2019). Moreover, FPA is a potential cost-saving policy for the health system. As Medicare pays NPs at 85% of the rate of physicians for the same services performed, cost savings may arise

from lower salaries and shorter training time for NPs relative to physicians. A simulation study in Alabama finds that more than $729 million could be saved if states remove SOP restrictions (Hooker and Muchow, 2015). Spetz et al. (2013) examine the costs associated with various NP SOP laws at retail clinics and conclude that savings would be $810 million greater if all states allow NPs to practice independently and $472 million greater if NPs can both practice and prescribe independently. A recent study by Smith (2022) finds that relaxing SOP laws does not change the volume or the allocation of patients to NPs, as well as the provision of low-value services. Therefore, FPA introduction may be cost-saving to the health system without harming patients and increasing unnecessary services.

This paper focuses on the two most important aspects of NP SOP laws: practice authority (treating patients) and prescriptive authority (prescribing medications). It is necessary to focus on practice and prescriptive authority jointly since the NPs' responsibilities are to diagnose, treat, and prescribe treatments. Some states allow NPs to practice independently, but not to prescribe without physician oversight[1]. For example, Arizona has permitted NPs to practice and prescribe medications independently without physician oversight since 1999, while Arkansas currently allows independent practice if the NP does not prescribe (McMichael and Markowitz, 2020). Therefore, NPs in states with laws granting NPs independence in both practice and prescriptive authority are deemed to have "full practice authority" (FPA). States with laws requiring physician oversight in either practice or prescriptive authority are classified as states with no FPA. This definition of

[1]In this paper, the term "independence" is used when the SOP law does not require physician supervision or collaboration.

FPA for NPs is consistent with previous studies on SOP laws (Markowitz et al., 2017; Traczynski and Udalova, 2018; Kandrack et al., 2021).

Despite increasing literature on SOP laws, the effects of FPA on long-term care utilisation remain ambiguous. The demand for healthcare theory suggests that utilisation of long-term care may increase as a substitution for the reduction in hospital care (Van Houtven and Norton, 2004). Empirical studies have also found evidence of the existing link between hospital care and long-term care (Johri et al., 2003; Wanless, 2006). Using home care services may reduce hospital care, through allowing timely discharge or through better management of long-term conditions (Forder, 2009; Forder et al., 2019). However, improvement in health outcomes resulting from better access to care and better care management may reduce the need for long-term care. Moreover, existing studies have shown, in states with FPA, the effects on health outcomes and primary care utilisation are significantly larger in medically underserved areas (Markowitz et al., 2017; Traczynski and Udalova, 2018; Alexander and Schnell, 2019). Therefore, we hypothesise that FPA may have different effects in areas with fewer doctors where access to physician-delivered services is more difficult. This paper contributes to the existing literature by providing a comprehensive evaluation of FPA implementation on long-term care utilisation using the DiD framework and the Health and Retirement Study (HRS), of which the next section will provide more details.

3. Data

We use the Health and Retirement Study (HRS) to investigate the effect of granting NPs FPA on long-term care utilisation. HRS is a nationally represen-

tative U.S. longitudinal study of community-dwelling adults aged 51 and over. The HRS survey has been conducted biannually since 1992 and has followed individuals born between 1931 to 1941 and their spouses. In 1993, a new cohort "AHEAD", including people born before 1924, was added to the data. Subsequent samples have periodically been added to maintain the sample of people above 50 years of age. As long-term care utilisation is more common among the older cohorts, this paper includes individuals from four different cohorts: AHEAD (born 1890–1923), HRS (born 1931–41), CODA (born 1924-1930), and WB (born 1942-1947). The HRS contains information on the long-term care utilisation, inpatient care, self-reported health status, and functional status. The data also contains a rich set of individual and household characteristics, including age, race, gender, ethnicity, education, income, health conditions, and insurance status. In this paper, we are able to access the restricted version of the HRS, which includes information on individuals' states of residence.

Before 1998, Medicare paid NPs indirectly, through services incident to physician services, with many private insurers maintaining similar restrictions. Following the passage of the Balanced Budget Act in 1997, Medicare and many private insurers began directly reimbursing NPs (Frakes and Evans, 2006; McMichael and Markowitz, 2020). Therefore, we limit the analysis to 1998-2018 because technically, before 1998, NPs were not considered independent providers yet. To avoid potential selection bias into treatment (i.e. individuals moved states to access NP services), we keep a balanced panel of individuals who have not moved states during the interview period ($\sim 66.9\%$). This restriction excludes individuals from Hawaii, Idaho, Maine, Montana, South Dakota, Utah, and Vermont since they are

not observed in all periods (less than 1%). The sample is now treated as a repeated cross-section of information about individuals in different states over time. Overall, the final sample has 23,606 observations with 2,146 individuals. Because the HRS oversamples minorities and residents in certain states (Ofstedal et al., 2011), a weighted model using HRS-provided weights is also estimated as a robustness check.

3.1. Scope of practice laws

Our primary data source for laws governing NP practice is based on the classification developed by McMichael and Markowitz (2020), using state statutes and state board of nursing rules and regulations. This classification is consistent with statutes, regulations, court cases and aligns with current policy discussions. Following Traczynski and Udalova (2018); McMichael and Markowitz (2020), FPA for NPs is defined as the absence of legal requirements for physician collaborations or supervision as a condition of NPs practising and prescribing. The FPA status in each state is then matched over time with the respondents' state of residence collected in the restricted version of the HRS.

Figure 1 shows variations of SOP laws across the states. Since Montana granted FPA in 1984, the number of states allowing NPs to have full independence has increased. Detailed effective dates are shown in Table A.9. As of 2018, 28 states granted FPA, with 18 states granting FPA between 1998 and 2018. As the HRS spans 1998-2018, the model identifies the effect of FPA based on law changes in AZ, CO, CT, DE, IL, MD, MN, NE, NV, NY, ND, RI, VA, WA, WV. It is difficult to say how states decide when to grant NPs FPA. Previous studies argue that state SOP laws are often influenced by political appointees, attorney general

opinion, or other political bargaining factors rather than population health (Safriet, 2002; Isaacs and Jellinek, 2013; McMichael, 2017). Traczynski and Udalova (2018) provide empirical evidence that healthcare utilisation and health outcomes explain only 7-16% of the variation in the timing of the law's passage. Therefore, we treat the timing of state law changes as exogenous to long-term care utilisation and provide additional tests for the validity of this assumption in Section 5.

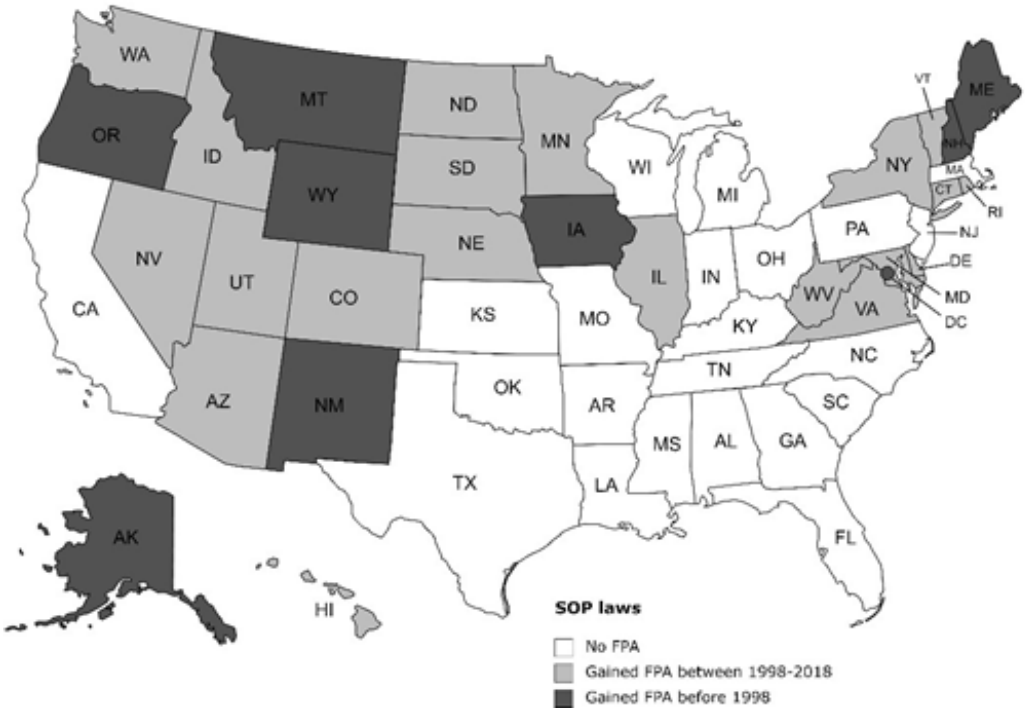

Figure 1: Changes in full practice authority for NPs

Source: Effective dates are from (McMichael and Markowitz, 2020)

3.2. Outcomes

We examine the effect of granting NPs FPA on long-term care utilisation, specifically on nursing home and home care utilisation. Each wave, the HRS asks the respondents whether they have had any overnight nursing home stay or whether they have used any home care services in the last two years. Home care services include nursing services by any medically trained person at an individual home. The uses of nursing home and home care are measured using a set of binary indicators and numbers of nights stayed in nursing homes.

As the HRS also collects information on hospitalisation, self-reported health status, and functional status, we also assess the effects of the FPA enactment on inpatient care and various health outcomes. Inpatient care is measured using a binary outcome equal to one if the respondent has stayed overnight in hospitals in the past two years. The HRS also asks respondents the number of nights they have spent in the hospital, which allows us to examine the effect of the FPA implementation on the intensive margin of inpatient care. In each wave, the HRS asks respondents to rate their health status on a 1-5 scale, with 5 representing poor health. Self-reported health status is measured using a dummy variable equal to one if the respondent reported having very good or excellent health.

To estimate the effects of FPA introduction on functional status, we use numbers of Activities of Daily Living (ADL) limitations and numbers of instrumental Activities of Daily Living (iADL) limitations. ADLs are activities related to personal care, including bathing, dressing, getting in/out of bed, walking across a room, and eating. iADLs are activities related to independent living, including

using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. Measurement of an individual's ADLs and iADLs is important as they predict nursing home admission, need for alternative living arrangements, hospitalisation, and use of paid home care (Rosenberg et al., 2019; Costenoble et al., 2019; Cagle et al., 2020). Higher numbers of ADLs and iADLs limitations imply worse functional status.

The HRS also collects information on respondents' physical and mental health. Therefore, we also examines the effect of granting FPA on older peoples' physical health measured as the number of chronic conditions. The Center for Epidemiological Studies-Depression (CESD) score - a clinically validated mental health scale is used to estimate the effect of FPA implementation on mental health outcomes, with a higher score implying worse mental health (Radloff, 1977).

Table 1 presents summary statistics for outcomes used in the analysis. Approximately 4.6 percent of respondents have used home care, whereas 1.5 percent of the respondents have stayed in nursing homes during the previous two years. On average, respondents have spent more than one night in a nursing home. Regarding inpatient care, 19.6 percent of the respondents have stayed overnight in the hospital, and they have stayed, on average, more than one night in the hospital. The final sample's long-term care utilisation closely resembles the national rates reported by the OECD in 2016 (OECD, 2016). More than 10 percent of the respondents reported having ADLs/iADL limitations, with the average numbers of ADL limitations being 0.118 and the average numbers of iADL limitations being 0.079. A typical individual in the sample has at least one chronic condition with

Table 1: Summary statistics - Outcomes

	Mean	**S.D**	**Min**	**Max**
Long-term care utilisation				
Any home care	0.046	0.209	0	1
Any nursing home stay	0.015	0.122	0	1
Numbers of nights in nursing home	1.122	23.068	0	730
Inpatient care				
Any hospital admission	0.196	0.397	0	1
Numbers of hospital nights	1.050	4.895	0	365
Health outcomes				
Excellent health = 1	0.539	0.498	0	1
Numbers of ADL limitations	0.118	0.478	0	5
Numbers of iADL limitations	0.079	0.382	0	5
CESD score	0.963	1.560	0	8
Numbers of chronic conditions	1.784	1.313	0	7
Observations	23,606	–		

Source: Health and Retirement Study (HRS), 1998 - 2018.

an average CESD score of 0.970.

3.3. Covariates

Table 2 presents summary statistics for covariates used in the analysis. A typical individual in the sample is a Caucasian, married, 69-years-old female who has

Table 2: Summary statistics - Covariates

	Full		**Non-FPA**		**FPA**		**Differences**
	Mean	*S.D*	*Mean*	*S.D*	*Mean*	*S.D*	
Individual characteristics							
Age	69.02	8.586	68.994	8.512	69.070	8.752	−0.076
Male	0.398	0.490	0.395	0.488	0.406	0.491	-0.011^{*}
Caucasian	0.870	0.336	0.858	0.349	0.898	0.303	-0.040^{***}
Hispanic	0.062	0.240	0.070	0.255	0.043	0.202	0.027^{***}
Married	0.696	0.460	0.702	0.457	0.683	0.465	0.018^{**}
Years of schooling (top coded 17)	13.306	2.670	13.143	2.756	13.674	2.424	-0.531^{***}
Currently employed	0.257	0.437	0.254	0.435	0.263	0.441	−0.001
Living in rural areas	0.082	0.275	0.083	0.275	0.081	0.274	0.001
Household characteristics							
Number of people in household	2.114	0.958	2.138	0.964	2.062	0.942	0.075^{***}
Household income ($10,000)	7.266	11.267	6.821	10.713	8.274	12.375	-1.453^{***}
Health insurance							
Covered by Medicare	0.674	0.469	0.676	0.468	0.670	0.470	0.006
Covered by Medicaid	0.034	0.180	0.036	0.187	0.027	0.162	0.009^{**}
Covered by private insurance	0.648	0.478	0.636	0.481	0.676	0.468	-0.040^{***}
Observations	23,606	–	16,379	–	7,227	–	

Note: $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Source: Author's calculation using Health and Retirement Study (HRS), 1998 - 2018.

completed high school education. On average, at least two individuals are living in the same household. Only 26 percent of the respondents work with an average household income of over $72,000. Two-thirds of the respondents are covered by Medicare[2]. We observe a similar pattern for private insurance coverage, with 65 percent of the respondents having private insurance. Over 3 percent of respondents are covered by Medicaid - a public insurance program targeting low-income families and people with disabilities. This pattern is not surprising given the sample's age and gender composition.

Table 2 also provides results from tests for difference-in-mean between states that never change their FPA status (i.e. Non-FPA states) and states where NPs have gained FPA as of 2018 (i.e. FPA states) in Table 2. There is no evidence that age, employment status, rural status, and Medicare coverage are significantly different between FPA and non-FPA states. However, individuals in FPA states are more educated with higher levels of income. Moreover, FPA states have a higher share of males and Caucasians, but have a lower share of Hispanic respondents. There are lower Medicaid coverage rates but higher private insurance rates in FPA states compared to non-FPA states. Therefore, it is important to include these characteristics in the estimation to prevent omitted variable bias and improve its precision.

[2]Medicare is a public program for people aged 65 and older. Despite being covered by Medicare, many older Americans still have private funding for medical services not covered under Medicare, such as dental care, outpatient services, or for the residual share of the doctor visits costs.

4. Empirical approach

This paper examines the effect of granting NPs FPA on long-term care utilisation using the DiD specification:

$$Y_{ist} = \beta_0 + \beta_1 \text{FPA}_{st} + \beta_2 X_{it} + \alpha_s + \delta_t + \varepsilon_{ist} \tag{1}$$

where Y_{ist} is an outcome of interest for individual i in state s in year t, FPA_{st} is an indicator equal to one if state s grants NPs FPA in year t, X_{it} are individual-level covariates, α_s and δ_t are year and state fixed effects. The model controls for age, gender, race, ethnicity, marital status, education, household size, living in rural areas, health insurance status, employment status, and income.

One important assumption of the DiD framework is the parallel trends assumptions that there would be no differences in the long-term care utilisation between individuals in FPA states compared with similar individuals in non-FPA states before SOP laws change. To test this assumption, we estimate an event study model. This model allows the effects of FPA to differ across years and includes pre-law passage estimates as a falsification test. The event study model replaces FPA_{st} with a vector of dummy variables, Relativetime_{st}, indicating relative time from the FPA implementation. To improve the precision of estimates and avoid single-year cells, we group data into 24-month periods, with all observations from non-FPA states set at $t = -1$. This omitted category includes the 24 months (i.e. 1-2 years) before the FPA effective date in states that change their SOP laws. Following Traczynski and Udalova (2018), we pool observations from 11 or more years after the implementation of FPA into the final period (11+ years after) to estimate the long-term effects. Similarly, all data 9 years or more before the law

passage are grouped into the earliest period (9+ years prior). States that have not granted FPA by the end of the study period are coded as zero for all groups. The event study model is written as follows:

$$Y_{ist} = \beta_0 + \beta_k \sum \text{Relativetime}_{st} + \beta_2 X_{it} + \alpha_s + \delta_t + \varepsilon_{ist} \quad (2)$$

where the key parameter of interest is β_k which estimates the period k FPA effect ($k \geq 0$) relative to the 24-month prior to the adoption of FPA. Validation of the parallel trends assumptions requires that $\beta_k = 0$, for all $k < 0$.

FPA introduction may influence long-term care utilisation, especially for the population living in areas with insufficient supply for primary care providers. To allow the impact of granting FPA to differently influence the utilisation of long-term care services in counties with under-provision of primary care services, the FPA status is interacted with an indicator for medically underserved counties and estimated using the following equation:

$$Y_{isct} = \beta_0 + \beta_1 \text{FPA}_{st} + \beta_2 (\text{FPA}_{st} \times \text{MUA}_{sc}) + \beta_3 X_{it} + \lambda_c + \delta_t + \varepsilon_{isct} \quad (3)$$

where Y_{isct} are outcomes for individual i living in county c of state s in year t. MUA_{sc} is an indicator that equals one if county c in state s was a medically underserved area (MUA) in 1998, and zero otherwise. Medically underserved areas are designated by the U.S. Health Resource and Service Administration (HRSA)"as having too few primary care providers, high infant mortality, high poverty or a high elderly population". The model controls for the same set of individual-level covariates and fixed effects as in Equation (1). The model also includes county fixed effects (λ_c) to account for potential heterogeneity across counties.

All models are pooled and estimated using a linear probability model (LPM). The LPM model is the preferred model for all estimations, as it provides direct estimates of the policy impact under the DiD framework. Moreover, it avoids the complications associated with the estimation and interpretation of multiple interaction terms, as well as their standard errors, in non-linear models (Deb and Norton, 2018). Standard errors are clustered at state-year levels to account for potential correlation within states over time. To improve the precision of estimations with clustered standard errors, the inference is conducted based on 999 bootstrap samples with confidence intervals and p-values using wild bootstrap (Cameron and Miller, 2015).

5. Results

5.1. Long-term care utilisation

We first estimate the effect of granting NPs FPA on the utilisation of home care and nursing home using the DiD estimation in Equation (1). Table 3 presents the Intention-to-Treat estimates of FPA implementation on long-term care utilisation. The probability that an older individual has used any home care services decreases by 1.7 percent points after states grant NPs FPA. Given that 4.6% of respondents report having used home care services, this reduction represents a 36% decrease at the extensive margin of home care, equivalent to the individual in non-FPA states being eight years younger. On the other hand, there is no evidence that FPA significantly affects older individuals' decision to use nursing homes, at both its intensive and extensive margins.

Table 4 reports results using the event study model, described in Equation

Table 3: Effects of FPA on older adults' long-term care utilisation

	Home care	**Nursing home**	**Nursing home nights**
	(1)	(2)	(3)
FPA = 1	-0.019***	-0.001	-0.016
	(0.007)	(0.005)	(1.582)
	[-0.035, -0.003]	[-0.011, 0.009]	[-3.112, 3.589]
Observations	23,606	23,606	23,606
Adjusted R-squared	0.028	0.026	0.016
Mean outcomes	0.046	0.015	1.122

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. Mean outcomes reports the mean of dependent variables listed at top. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Table 4: Event study - Pre-trends tests

Years relative to FPA	**Home care**	**Nursing home**	**Nursing home nights**
	(1)	(2)	(3)
9+ years prior	-0.001	-0.003	-0.462
	(0.008)	(0.005)	(0.796)
	[-0.019, 0.018]	[-0.015, 0.009]	[-2.506, 1.297]
7-8 years prior	-0.001	-0.000	-0.314
	(0.009)	(0.005)	(0.656)
	[-0.020, 0.022]	[-0.012, 0.013]	[-1.654, 0.900]
5-6 years prior	-0.003	-0.003	-0.618
	(0.012)	(0.005)	(0.703)
	[-0.033, 0.025]	[-0.015, 0.010]	[-2.042, 0.738]
3-4 years prior	-0.009	-0.004	-0.653
	(0.011)	(0.005)	(0.700)
	[-0.034, 0.019]	[-0.018, 0.007]	[-2.135, 0.682]
Year of implementation	0.001	0.001	-0.875
	(0.017)	(0.006)	(1.587)
	[-0.054, 0.041]	[-0.014, 0.015]	[-5.277, 3.041]
1-2 years after	-0.022*	0.004	-1.597*
	(0.011)	(0.006)	(0.879)
	[-0.043, 0.005]	[-0.010, 0.018]	[-3.334, 0.170]
3-4 years after	-0.030**	-0.009	1.231
	(0.011)	(0.010)	(3.576)
	[-0.056, -0.002]	[-0.030, 0.017]	[-6.273, 12.750]
5-6 years after	-0.034**	-0.014**	-1.648
	(0.011)	(0.006)	(1.138)
	[-0.062, -0.006]	[-0.027, -0.000]	[-3.950, 0.740]
7-8 years after	-0.022*	-0.002	0.190
	(0.011)	(0.011)	(3.049)
	[-0.048, 0.003]	[-0.035, 0.025]	[-5.834, 11.18]
9-10 years after	-0.025*	-0.012	-1.999
	(0.012)	(0.009)	(1.720)
	[-0.068, 0.003]	[-0.032, 0.015]	[-3.550, 5.404]
11+ years after	-0.019	0.004	2.598
	(0.014)	(0.008)	(3.045)
	[-0.052, 0.015]	[-0.014, 0.023]	[-4.040, 11.120]
Observations	23,606	23,606	23,606
p-value ($H_0 : \beta_k = 0, \forall k < 0$)	0.978	0.944	0.837

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

(2) to examine the parallel trends assumptions. As indicated in the p-value of the pre-trend tests, all pre-treatment dummies are not statistically different from zero. These pre-treatment dummies provide evidence that the timing of FPA is exogenous to long-term care utilisation. The lack of statistical significance in pre-FPA differences between states that grant NPs FPA and states that do not is consistent with the parallel trends assumption. Pre-trend tests for other outcomes are reported in Appendix B.

5.2. Medically underserved areas

Table 5: Effects of FPA on medically underserved areas

	Home care	**Nursing home**	**Home nights**
	(1)	(2)	(3)
FPA	0.009	0.004	-0.076
	(0.007)	(0.005)	(1.383)
	[-0.025, 0.004]	[-0.006, 0.014]	[-2.789, 2.999]
FPA × Underserved	-0.061**	-0.037***	-1.609
	(0.026)	(0.013)	(1.549)
	[-0.112, -0.005]	[-0.063, -0.009]	[-4.814, 1.702]
Observations	23,606	23,606	23,606
Mean outcomes	0.046	0.015	1.104
$\beta_1 + \beta_2$	-0.072	-0.033	-1.685
P-value ($H_0 : \beta_1 + \beta_2 = 0$)	0.005	0.008	0.106

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE, county FE and year FE. Mean outcomes reports the mean of dependent variables listed at top. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Existing literature has shown that the effect of FPA on primary care utilisation and health outcomes differ significantly in areas with an insufficient supply of primary care providers (Markowitz et al., 2017; Traczynski and Udalova, 2018; Alexander and Schnell, 2019; Yang et al., 2021). Low provider supply may lead to poor access to primary care services, thus resulting in worse health outcomes

and higher needs for long-term care services. Therefore, granting NPs FPA may have a larger impact in medically underserved areas. The 1998 HRSA designated indicator for medically underserved counties is used as a proxy for primary care provider shortage to test this hypothesis.

Table 5 reports the results of estimating Equation (3). As expected, the reduction in long-term care utilisation is statistically larger in medically underserved counties. In states that grant FPA, individuals in underserved counties experience a 7.2% reduction in the probability of using home care and a 3.3% reduction in the probability of nursing home entry. These findings indicate that the main results are driven by features of the primary care market. These results also suggest that granting NP FPA can help improve the health outcomes of older adults in medically underserved areas.

5.3. Heterogeneous effects of FPA

The effect of FPA on long-term care utilisation may vary based on individuals' characteristics such as age, gender, race, ethnicity, education, location, and insurance status. The possible heterogeneous response to states granting NPs FPA is investigated by modifying Equation (1) to include the interactions between the treatment effect and indicators for different individual characteristics.

Overall, there is little evidence that the effect of FPA is heterogeneous, except for race and insurance status[3]. Table 6 reports results using seven possible dimen-

[3]We use insurance status at baseline to prevent changes in insurance coverage during the interview period.

Table 6: Heterogeneous effects of FPA on long-term care utilisation

	Home care	**Nursing home**	**Home nights**
FPA × Male	-0.014	0.001	-0.455
	(0.009)	(0.006)	(1.424)
	[-0.032, 0.004]	[-0.011, 0.013]	[-3.247, 2.337]
FPA × Female	-0.022**	-0.002	0.296
	(0.009)	(0.006)	(1.299)
	[-0.040, -0.005]	[-0.014, 0.011]	[-2.250, 2.843]
FPA × Age $\geq$ 65	-0.019**	-0.001	-0.060
	(0.008)	(0.006)	(1.293)
	[-0.035, -0.004]	[-0.012, 0.010]	[-2.593, 2.473]
FPA × Age $<$ 65	-0.015	-0.006	0.118
	(0.011)	(0.007)	(1.267)
	[-0.036, 0.006]	[-0.019, 0.007]	[-2.367, 2.602]
FPA × Caucasian	-0.015*	-0.000	0.136
	(0.008)	(0.006)	(1.288)
	[-0.031, 0.001]	[-0.011, 0.011]	[-2.388, 2.660]
FPA × Non-Caucasian	-0.047***	-0.006	-1.103
	(0.014)	(0.010)	(0.960)
	[-0.074, -0.019]	[-0.025, 0.014]	[-2.984, 0.778]
FPA × Hispanic	-0.036*	-0.001	-0.486
	(0.018)	(0.013)	(1.111)
	[-0.072, -0.000]	[-0.026, 0.023]	[-2.663, 1.691]
FPA × Non-Hispanic	-0.018**	-0.001	0.008
	(0.008)	(0.006)	(1.226)
	[-0.034, -0.002]	[-0.012, 0.010]	[-2.395, 2.411]
FPA × High school or higher	-0.019**	0.000	-0.017
	(0.008)	(0.005)	(1.157)
	[-0.035, -0.003]	[-0.010, 0.011]	[-2.286, 2.251]
FPA × Less than High school	-0.020	-0.013	-0.014
	(0.015)	(0.010)	(2.930)
	[-0.051, 0.010]	[-0.034, 0.008]	[-5.757, 5.729]
FPA × Rural	-0.030*	0.008	2.010
	(0.017)	(0.014)	(3.860)
	[-0.063, 0.004]	[-0.020, 0.036]	[-5.556, 9.575]
FPA × Non-rural	-0.018**	-0.002	-0.223
	(0.008)	(0.006)	(1.215)
	[-0.033, -0.001]	[-0.013, 0.009]	[-2.604, 2.158]
FPA × Any insurance	-0.017**	0.001	0.291
	(0.008)	(0.006)	(1.269)
	[-0.034, -0.003],	[-0.010, 0.012]	[-2.195, 2.777]
FPA × No insurance	-0.028**	-0.014*	-2.216**
	(0.012)	(0.008)	(1.023)
	[-0.052, -0.005]	[-0.030, 0.002]	[-4.223, -0.210]
Observations	23,606	23,606	23,606

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE, county FE and year FE. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

sions of heterogeneity, including both individual and geographical characteristics. The impacts of FPA introduction on long-term care utilisation are similar between males and females, below and above 65 years old, Hispanic and non-Hispanic, less than and at least high school degrees completion, in rural and non-rural areas. In these specifications, the confidence intervals for each group include the point estimates of the comparison groups[4]. On the other hand, there is a significantly larger reduction in home care utilisation for non-Caucasian individuals than similar Caucasian individuals. Granting NPs FPA reduces the probability of nursing home entry more for uninsured individuals than people with health insurance. These findings suggest that granting NPs FPA can have positive impacts on the disadvantaged population.

5.4. Robustness checks

As robustness checks, we perform several specification tests using Equation (1), with estimations reported in Appendix C. As the HRS oversamples individuals of minorities and residents in certain states (Ofstedal et al., 2011), we re-estimate the treatment effects using individual-level weights provided in the HRS. The weighted estimates are slightly larger but are not substantially different from the estimates from the unweighted models. Then, Equation (1) is re-estimated to include group-specific linear trends, one for states that never grant FPA and one for states that do. The treatment effects are similar to the ones in the main results.

As many states have granted NP FPA around the same time as the passage

[4] An F-test for equality of the point estimates is also conducted and fails to reject the hypothesis that the coefficients are equals.

of the ACA, the timing of FPA introduction may have been influenced by the increased demand for primary care resulting from the ACA. Therefore, controlling for individuals' insurance status may not fully capture the incremental changes in the health insurance plan before and after the ACA. Following Traczynski and Udalova (2018), such changes in state health insurance markets are accounted for using state-specific cubic trends in the share of insured population[5]. The inclusion of these trends slightly increases estimates of treatment effects, however, they are not substantially different from the main results.

Since macroeconomic conditions can influence nursing supply (Konetzka et al., 2018), it may also influence demand for long-term care services. Changes in macroeconomics conditions are captured using county-level unemployment rates, collected from the U.S. Bureau of Labor Statistics during 1998-2018. There is no evidence that adding county-level unemployment rates changes the main results.

Potential unobservable time-invariant characteristics may influence individual decisions to use long-term care, including preferences or risks. Therefore, we estimate Fixed Effects (FE) models to account for time-invariant confounders at individual levels. Since individuals in the sample have not moved during the interview period, one advantage of the FE estimation is that it can also control for any unobserved time-invariant characteristics at geographical levels. Since the FE model uses within-individual variations, estimates for standard errors may be larger than the pooled model. However, the FE estimates of treatment effects are

[5]Data on states' share of insured population is from U.S. Census Bureau.

similar to the main models.

The expected effect (i.e. average treatment effect) of NP FPA in states that do not grant FPA yet is also estimated. If long-term care utilisation is uncorrelated with both the observables and unobservables of states that grant FPA, then the assumption that the treatment status is random conditional on covariates is supported. To test this, state fixed effects in Equation (1) are replaced with an indicator for whether a state has ever granted FPA. The lack of statistical significance in the coefficients indicates no level differences in long-term care utilisation between states that grant FPA and states that do not, conditioning on the covariates. This evidence suggests that the average treatment effects are comparable to treatment-on-treated estimates. In other words, changes in long-term care utilisation for new states granting FPA are expected to be similar to the estimated impacts in Table 3.

5.5. Potential pathways

Given the interdependencies between long-term care and inpatient care (Forder, 2009; Forder et al., 2019), the reduction in home care services resulting from states granting FPA may not be cost-saving if individuals substitute long-term care with inpatient care. Therefore, the effect of FPA on hospital admission and the number of hospital nights is examined. The impact of FPA on inpatient care is presented in Table 7 - Columns (1) and (3). There is no evidence that individuals substitute long-term care with inpatient care, as the effect of FPA introduction on the probability of hospital admission is statistically insignificant. These findings are similar to evidence in the existing literature that individuals in states granting FPA spend fewer nights in hospitals (Traczynski and Udalova, 2018). Because the average

Table 7: Effects of FPA on inpatient care

	Hospital admission	**Hospital admission**	**Hospital nights**	**Hospital nights**
	(1)	(2)	(3)	(4)
FPA = 1	-0.014	0.009	-0.035**	-0.129
	(-0.011)	(0.010)	(0.139)	(0.112)
	[-0.040, 0.013]	[-0.013, 0.031]	[-0.647, -0.067]	[-0.361, 0.093]
FPA × Underserved		-0.167***		-0.954***
		(0.032)		(0.192)
		[-0.229, -0.101]		[-1.317, -0.578]
Observations	23,606	23,606	23,606	23,606
Mean outcomes	0.196	0.196	1.050	1.050
$\beta_1 + \beta_2$		-0.158		-1.082
P-value ($H_0 : \beta_1 + \beta_2 = 0$)		0.000		0.000

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE, county FE and year FE. Mean outcomes reports the mean of dependent variables listed at top. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$

number of hospital nights is 1.050 nights, granting FPA is estimated to result in an approximately 3 percent reduction in hospital nights. The effect of removing physician oversight requirements on inpatient care for individuals in medically underserved counties is also reported in Table 7 - Columns (2) and (4). Similar to findings from existing literature, we also find that FPA introduction has statistically larger effects on numbers of hospital nights in medically underserved counties, at both extensive and intensive margins.

This evidence suggests that FPA may influence long-term care utilisation through

health improvement. Existing studies have emphasised the positive impacts of granting NP independence on self-reported health status and mental health (Traczynski and Udalova, 2018; Alexander and Schnell, 2019). Another possible channel through which increased access to primary care after states granting FPA affects long-term care utilisation is better management of chronic conditions. Since having multiple chronic conditions is associated with an increase in functional limitations (Jindai et al., 2016), better condition management can slow down functionality deterioration or even improve patient functional status. A review of international studies on the role of NPs in geriatric primary care reveals that NPs have positive impacts on patients' clinical outcomes and functional status which are important determinants of long-term care utilisation (Chavez et al., 2018). To test these theories, we assess the effect of FPA on a range of individuals' health outcomes collected by the HRS. Table 8 summarises and presents the results for these health outcomes.

Table 8: Effects of FPA on health outcomes

	Excellent health	**Excellent health**	**ADLs**	**ADLs**	**iADLs**	**iADLs**
	(1)	(2)	(3)	(4)	(5)	(6)
FPA = 1	-0.006	0.012	-0.016	0.003	-0.023*	0.009
	(-0.010)	(0.011)	(0.016)	(0.013)	(0.012)	(0.011)
	[-0.027, 0.015]	[-0.010, 0.036]	[-0.054, 0.025]	[-0.024, 0.029]	[-0.050, 0.005]	[-0.013, 0.032]
FPA × Underserved		0.250**		-0.147***		-0.111***
		(0.066)		(0.031)		(0.029)
		[0.104, 0.413]		[-0.209, -0.084]		[-0.174, -0.048]
Observations	23,606	23,606	23,606	23,606	23,606	23,606
Mean outcomes	0.539	0.539	0.118	0.118	0.079	0.079
$\beta_1 + \beta_2$		0.262		-0.144		-0.102
P-value ($H_0 : \beta_1 + \beta_2 = 0$)		0.000		0.000		0.000
	CESD	**CESD**	**Chronic conditions**	**Chronic conditions**		
	(7)	(8)	(9)	(10)		
FPA = 1	0.025	-0.055*	-0.028	0.042		
	(0.039)	(0.031)	(0.021)	(0.029)		
	[-0.060, 0.117]	[-0.119, 0.007]	[-0.076, 0.016]	[-0.018, 0.106]		
FPA × Underserved		-0.484**		-0.845***		
		(0.173)		(0.121)		
		[-0.834, -0.106]		[-1.097, -0.596]		
Observations	23,606	23,606	23,606	23,606		
Mean outcomes	0.963	0.963	1.784	1.784		
$\beta_1 + \beta_2$		-0.539		-0.803		
P-value ($H_0 : \beta_1 + \beta_2 = 0$)		0.002		0.000		

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. Mean outcomes reports the mean of dependent variables listed at top. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$

Overall, we find that granting NPs FPA does not affect public health, as evidenced by the insignificant effects on most health outcomes. However, there is evidence that the number of iADL limitations is significantly lower in states granting FPA, roughly by 29 percent compared to the sample mean. In medically underserved counties, granting NPs FPA reduces the numbers of ADLs, iADLs and chronic conditions. Individuals in medically underserved counties also have better self-reported health status and mental health scores where NPs can practice and prescribe independently. Previous studies have shown that FPA introduction increases access to care and primary care utilisation (Traczynski and Udalova, 2018). As primary care is cheaper than inpatient care and long-term care, our findings suggest that granting NPs FPA can help achieve cost-saving through improving population health and reducing more costly health services.

6. Discussion and Conclusion

Access to care remains an important policy priority in the United States. The recent COVID-19 pandemic has emphasised the importance of access to care as state governments implement various initiatives targeting healthcare providers to support the increased public demand for healthcare. One of the initiatives focuses on removing legal barriers that prevent NPs from practising to the full extent of their training. This paper complements existing studies on SOP laws. It provides evidence that granting NP full practice authority may have additional cost-savings effects by reducing the use of more expensive healthcare services.

We exploit the staggered adoption of states' FPA during 2006-2018 to evaluate the effect of granting NPs independence to practice and prescribe drugs on

long-term care utilisation. Using the DiD framework, the effect of FPA on the use of home care and nursing homes is investigated. The effects on older adults' inpatient care and health outcomes are also examined. There is substantial evidence that granting NPs FPA decreases long-term care utilisation and inpatient care. To put this into perspective, the reduction in long-term care utilisation can be as large as being eight years younger in non-FPA states. These reductions are likely a result of better health outcomes and better functional status.

Overall, we find strong evidence suggesting that FPA introduction is not harmful to the older population's health. These findings have important implications for financial planning in health systems. Previous studies have shown that access to care and primary care utilisation is more readily available in states granting FPA (Traczynski and Udalova, 2018). As the cost of long-term care and inpatient care are high relative to primary care (WHO, 2018), our results suggest that older individuals substitute away from these expensive services when primary care is more readily available. We also find that utilisation avoidance and health gains from the FPA implementation are robust across the population, with more significant gains in medically underserved counties. These findings suggest that changing SOP laws can be an effective policy tool to reduce the health gaps in disadvantaged communities and help states achieve cost savings in the health system.

Appendix A. Nurse Practitioner Scope of Practice Laws, 1998–2020

Table A.9: Nurse Practitioner Scope of Practice Laws

State	Abbreviation	FPA status
Alabama	AL	Never
Alaska	AK	Always[†]
Arizona	AZ	December 1999
Arkansas	AR	Never
California	CA	Never
Colorado	CO	July 2010
Connecticut	CT	July 2014
Delaware	DE	September 2015
District of Columbia	DC	Always[†]
Florida	FL	July 2020
Georgia	GA	Never
Hawaii	HI	July 2009
Idaho	ID	July 2004
Illinois	IL	June 2019
Indiana	IN	Never
Iowa	IA	Always[†]
Kansas	KS	Never
Kentucky	KY	Never
Louisiana	LA	Never
Maine	ME	Always[†]

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Table A.9 – continued from previous page

State	Abbreviation	FPA status
Maryland	MD	October 2010
Massachusetts	MA	Never
Michigan	MI	Never
Minnesota	MN	January 2015
Mississippi	MS	Never
Missouri	MO	Never
Montana	MT	Always[†]
Nebraska	NE	March 2015
Nevada	NV	July 2013
New Hampshire	NH	Always[†]
New Jersey	NJ	Never
New Mexico	NM	Always[†]
New York	NY	January 2015
North Carolina	NC	Never
North Dakota	ND	October 2011
Ohio	OH	Never
Oklahoma	OK	Never
Oregon	OR	Always[†]
Pennsylvania	PA	Never
Rhode Island	RI	February 2012
South Carolina	SC	Never
South Dakota	SD	February 2017

Continued on next page

Table A.9 – continued from previous page

State	Abbreviation	FPA status
Tennessee	TN	Never
Texas	TX	Never
Utah	UT	May 2016
Vermont	VT	June 2011
Virginia	VA	April 2018
Washington	WA	July 2005
West Virginia	WV	June 2016
Wisconsin	WI	Never
Wyoming	WY	Always[†]

[†] State has always allowed full practice authority since at least 1998.

Source: McMichael and Markowitz (2020).

Appendix B. Event study - Pre-trends tests

This paper uses Equation (2) to test the validity of the parallel trends assumptions on other outcomes: inpatient care and health. Table B.10 presents estimates from the pre-FPA time dummies for eight outcomes. Across the 40 pre-trend dummy variables, only one of them is statistically significant at a 5% level. This pattern is consistent with expected rates of Type I error. The joint F-tests fail to reject the hypothesis that there are no differential trends in inpatient care and health outcomes between states that grant FPA and states that do not. We interpret these findings as evidence of the parallel trends assumptions underlying the DiD framework.

Table B.10: Event study - Pre-trends tests

Years relative to FPA	**Hospital admission**	**Hospital nights**	**Excellent health**	**ADLs**
	(1)	(2)	(3)	(4)
9+ years prior	0.019	-0.107	0.002	0.044
	(0.014)	(0.356)	(0.016)	(0.023)
	[-0.019, 0.050]	[-1.126, 0.500]	[-0.032, 0.072]	[-0.009, 0.102]
7-8 years prior	0.012	0.047	0.003	0.024
	(0.017)	(0.359)	(0.017)	(0.022)
	[-0.030, 0.048]	[-0.767, 0.777]	[-0.037, 0.047]	[-0.030, 0.081]
5-6 years prior	0.052**	0.012	0.018	0.016
	(0.018)	(0.351)	(0.022)	(0.023)
	[0.007, 0.096]	[-0.808, 0.635]	[-0.032, 0.072]	[-0.041, 0.079]
3-4 years prior	0.009	-0.287	-0.024	0.014
	(0.017)	(0.370)	(0.018)	(0.025)
	[-0.032, 0.049]	[-1.241, 0.428]	[-0.068, 0.021]	[-0.052, 0.082]
Observations	23,606	23,606	23,606	23,606
p-value ($H_0 : \beta_k = 0, \forall k < 0$)	0.225	0.689	0.451	0.331

Years relative to FPA	**iADLs**	**CESD**	**Chronic conditions**
	(5)	(6)	(7)
9+ years prior	0.004	0.071	-0.022
	(0.015)	(0.068)	(0.025)
	[-0.031, 0.046]	[-0.105, 0.232]	[-0.088, 0.027]
7-8 years prior	0.008	0.013	-0.030
	(0.018)	(0.081)	(0.034)
	[-0.042, 0.054]	[-0.184, 0.227]	[-0.112, 0.054]
5-6 years prior	0.016	0.027	-0.027
	(0.018)	(0.075)	(0.031)
	[-0.026, 0.056]	[-0.163, 0.215]	[-0.010, 0.040]
3-4 years prior	0.024	0.052	-0.013
	(0.015)	(0.072)	(0.025)
	[-0.010, 0.063]	[-0.126, 0.232]	[-0.074, 0.042]
Observations	23,606	23,606	23,606
p-value ($H_0 : \beta_k = 0, \forall k < 0$)	0.452	0.822	0.931

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Appendix C. Robustness and Sensitivity

Table C.11: Weighted effects of FPA on long-term care utilisation

	Home care	**Nursing home**	**Nursing home nights**
FPA = 1	-0.024**	-0.002	-0.691**
	(0.007)	(0.004)	(0.300)
	[-0.041, -0.009]	[-0.011, 0.006]	[-1.329, -0.017]
Observations	21,382	21,382	21,382
Adjusted R-squared	0.018	0.015	0.002
Mean outcomes	0.038	0.011	0.372

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. Mean outcomes reports the mean of dependent variables listed at top. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Table C.12: Additional specification tests

	Group-specific trends		
	Home care	*Nursing home*	*Home nights*
FPA = 1	-0.018*	-0.002	-0.361
	(0.009)	(0.005)	(1.473)
	[-0.037, -0.002]	[-0.013, 0.009]	[-3.441, 3.046]
	State-specific trends for insurance coverage rates		
	Home care	*Nursing home*	*Home nights*
FPA = 1	-0.021**	-0.005	-0.901
	(0.007)	(0.004)	(1.358)
	[-0.037, -0.005]	[-0.014, 0.004]	[-3.728, 2.189]
	County unemployment rates		
	Home care	*Nursing home*	*Home nights*
FPA = 1	-0.019**	-0.001	-0.057
	(0.007)	(0.005)	(1.580)
	[-0.034, -0.003]	[-0.011, 0.009]	[-3.294, 3.740]
	Individual FE		
	Home care	*Nursing home*	*Home nights*
FPA = 1	-0.019**	-0.001	0.069
	(0.008)	(0.006)	(1.278)
	[-0.034, -0.004]	[-0.011, 0.010]	[-2.449, 2.593]
	Ever granted FPA		
	Home care	*Nursing home*	*Home nights*
Ever passed = 1	-0.003	0.001	0.008
	(0.003)	(0.002)	(0.416)
	[-0.009, 0.004]	[-0.003, 0.005]	[-0.816, 0.837]
Observations	23,606	23,606	23,606

Note: Standard errors are clustered at the state-year levels. Numbers in brackets represent limits of the 95% confidence interval, estimated using 999 bootstrap samples. Regressions include age, gender, marital status, education, rural status, employment status, household income, household size, insurance status, state FE and year FE. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

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