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Alleviating Worker Shortages Through Targeted Subsidies: Evidence from Incentive Payments in Healthcare

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ABSTRACT

Worker shortages are common in many industries. This paper examines the effect of government subsidies to address these shortages in the context of a reform that tied Medicaid payments to nursing home staffing levels. We find that the reform substantially increased staffing, especially for facilities serving many Medicaid patients. Facilities responded primarily by hiring workers in lower-wage roles rather than increasing hours of incumbent or high-wage staff. This contrasts with null effects we estimate for a non-incentivized rate increase, suggesting that the incentive structure of government payments—rather than just the level—is key to boosting employment in sectors facing worker shortages.

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A data appendix is available at http://www.nber.org/data-appendix/w32412

1 Introduction

Worker shortages are common in many industries. In sectors that serve important public needs, such as education, healthcare, transportation, social services, and law enforcement, low staffing can have devastating consequences including poor student educational outcomes (Angrist and Lavy, 1999; Das et al., 2007; Chetty et al., 2011), high patient mortality (Aiken et al., 2002; Gruber and Kleiner, 2012; Stevens et al., 2015; Friedrich and Hackmann, 2021), and more major accidents (Huerta et al., 2023; Steel and Ember, 2023). Because the government often regulates, finances, or operates these industries, policymakers have proposed numerous ways to increase staffing. These include raising wages or benefits where the government is an employer (Britton and Propper, 2016; Dal Bó et al., 2013), increasing payments where the government is a payer (Harrington et al., 2007; Hackmann, 2019), or setting standards such as minimum staffing requirements where the government is a regulator (Angrist and Lavy, 1999; Krueger, 1999; Harrington et al., 2000; Matsudaira, 2014; Lin, 2014).

This paper examines the efficacy of employment subsidies as a way for governments to increase staffing in particular industries. We leverage a 2022 reform in Illinois that tied a large component of nursing home Medicaid payments to facilities' staffing levels. This reform is unique, both in its size and that it directly connected Medicaid reimbursement to staffing levels. Other proposed or implemented Medicaid reforms typically either raise rates universally (Cohen and Spector, 1996; Hackmann, 2019; Gandhi, 2023) or base reimbursement on reported historical costs (Nyman, 1985a; Gertler, 1989, 1992; Cohen and Spector, 1996; Foster and Lee, 2015). In contrast, the Illinois reform provides large reimbursements to facilities as a function of actual staffing.

The nursing home industry is an ideal setting to study the effects of incentive payments on worker shortages for at least three reasons. First, nursing homes are a labor-intensive industry: nurse staffing costs exceed one-third of revenue for the typical firm (Bowblis et al., 2023), and worker shortages are common. Most facilities do not meet staffing standards four out of five days (Geng et al., 2019). The COVID-19 pandemic exacerbated these shortages (McGarry et al., 2020; Shen et al., 2022), even as nursing home occupancy dropped dramatically (Werner and Coe, 2021). The state we study, Illinois, faces the worst shortages in the country (Illinois HFS, 2023), and this shortage was a motivation for the reform. These shortages likely arise because since facilities receive payment on a per-diem basis—regardless of the quality of care—they may be reluctant to raise wages or increase staffing. Competition does little to alleviate these issues, since patients primarily choose facilities based on location, and nursing home quality can be difficult to measure or interpret, especially for the large fraction of residents with cognitive decline.

Second, nursing home employment has social welfare implications. Nursing homes serve approximately 1.3 million Americans per day, the vast majority of whose stays are financed by taxpayers through Medicare and Medicaid. These residents are a vulnerable population whose physical and cognitive impairments make it difficult for them to advocate for better care without government intervention. The Centers for Medicare & Medicaid Services (CMS) considers staffing to have "the greatest impact on the quality of care nursing homes deliver" (Centers for Medicare & Medicaid Services, 2019), and research likewise finds that poor staffing worsens resident health (Lin, 2014) and increases mortality (Friedrich and Hackmann, 2021). Indeed, the relationship between staffing levels and patient outcomes is so strong that staffing *itself* has become the *de facto* nursing home quality measure used most commonly by researchers, consumers, and regulators. Accordingly, there is substantial policy interest in increasing nursing home staffing. For example, many states have implemented minimum staffing requirements (Lin, 2014; Matsudaira, 2014), and CMS has proposed federal minimums (Grabowski and Bowblis, 2023).

Third, the healthcare industry is a prime example of an industry where even though services are primarily provided by private firms, the government finances many of these operations (Poterba, 1996). Other such industries include those that are heavily-reliant on government contracts, such as defense, construction, and manufacturing. While governments often aim to affect employment in these settings—e.g., by requiring or subsidizing use of union labor or imposing a higher minimum wage—there is little evidence on how government payments affect employment in these settings.

In order to examine the effect of incentive payments on staffing levels, we use a difference-in-differences event study approach that compares staffing changes at Illinois nursing homes occurring around the reform to within-facility changes in other states. We leverage administrative data on nearly every daily shift for every worker in the industry, which allows us to measure the effect of the policy on total employment, the type of workers that are employed, and the types of shifts that they work.

We find a sharp, substantial, and sustained increase in staffing after the incentive payments were implemented. The reform increased the staffing levels for the average facility by 5.35% of the clinical target, equivalent to 106.15 hours of staffing per week for the typical facility. The staffing increases were almost entirely concentrated in facilities with a large fraction of Medicaid patients and therefore a high degree of exposure to the incentive payments. We also find that firms were cost-conscious, increasing staffing primarily among low-wage certified nursing assistants (CNAs) rather than more highly-certified but higher-wage nursing staff. Facilities increased staffing primarily on the extensive margin, hiring new workers rather than increasing the hours worked by each employee or increasing retention of existing

employees. The incentive payments also slightly shifted facilities' employment composition towards part-time workers and contract staff. While greater use of contract staff has been associated with lower quality in previous work (Castle and Engberg, 2007; McMaster, 1995; Rebitzer, 1995), we still find suggestive evidence that clinical quality improved following the reform, consistent with higher staffing leading to better resident outcomes.

We contrast our findings with a 2019 reform that substantially raised Medicaid reimbursement rates but did not tie them to staffing or quality measures. Industry groups, academics, and policymakers often argue that such unconditional rate increases could improve staffing either by alleviating financial constraints (Harrington et al., 2007) or inspiring competition to attract Medicaid patients (Grabowski, 2001; Hackmann, 2019). Contrary to these assertions, we find no effect of the 2019 reform, suggesting that the incentive-based nature of the 2022 reform was a key driver of the reform's effectiveness.

While effective at increasing staffing, the 2022 incentive payments came at a significant financial cost to the government: the state paid out approximately $60.5 million in the first quarter of 2023 alone. However, our estimates indicate that a large share of spending on high-Medicaid facilities was passed-through to workers: each additional dollar of incentive payments generated $0.86 worth of staffing increases at market wages. This high degree of passthrough is because high-Medicaid facilities tended to have low staffing before the reform and therefore typically only received large payments when they substantially increased staffing. In contrast, payments to low-Medicaid facilities were far less effective: $1 in incentive payments to these facilities increased staffing by just $0.04. This lower passthrough occurs because low-Medicaid facilities also tended to have higher pre-reform staffing levels, and therefore received much larger per-patient payments even with minimal or no improvements to staffing. Finally, we note that because quality at nursing homes is a common good across all patients, some of the benefits of the staffing incentive payments accrue to non-Medicaid patients. Therefore, if Medicaid programs focus only on the benefits to Medicaid patients, this will miss some of the social benefits of the payment incentives.

2 Institutional background and policy reform

2.1 Staffing and care needs in nursing homes

Nursing homes provide residential and around-the-clock medical care to individuals who require assistance with activities of daily living (ADLs), such as eating, bathing, mobility, and toileting. Most residents are elderly, but their care needs can vary widely, from post-acute rehabilitative therapy to long-term skilled nursing care for various physical and cognitive

ailments. The typical nursing home resident receives 3.6 hours of daily care from a mix of three types of nursing staff: Registered Nurses (RNs), Licensed Practical Nurses (LPNs), and Certified Nursing Assistants (CNAs). The job tasks and educational requirements vary across these occupations. RNs, who typically have a 4-year nursing degree, develop treatment plans, administer medical treatment, and interpret medical results. LPNs typically have a 2-year degree, and they administer IVs and other basic medical treatment, prepare treatment rooms, and supervise CNAs. CNA work requires a credential, but typically no degree, and involves helping residents with activities of daily living, cleaning resident rooms, and communicating basic information with family members. Reflecting these different tasks and educational requirements, pay substantially differs across nursing occupations. For example, in May 2022, median CNA pay in nursing homes was $17.06/hour, LPN pay was $28.10/hour, and RN pay was $36.53/hour (Bureau of Labor Statistics, 2023).

Higher staffing levels, especially among licensed nurses (i.e., LPNs and RNs) are associated with a higher quality of care (Lin, 2014; Mukamel et al., 2022, 2023) for health outcomes (Figueroa et al., 2020; Friedrich and Hackmann, 2021) and for quality of life more generally (Shippee et al., 2015). Indeed, given the labor-intensive nature of nursing home care, staffing levels are often relied on as a standalone proxy for quality. All states have implemented some form of minimum staffing requirements (Consumer Voice, 2021), and staffing levels are one of three key quality indicators on CMS's consumer-facing Nursing Home Compare website.

Because the care needs of residents varies across facilities, a facility's staffing level must be compared relative to the needs of its residents. To measure resident care needs, the federal government uses mandatory health assessments to categorize each resident into one of 66 Resource Utilization Groups ("RUG") based on the severity of their clinical and functional needs. CMS then maps these RUGs to a "clinical target" amount of care based on the CMS Staff Time Resource Intensity Verification (STRIVE) study. Summing the STRIVE targets of patients in a facility gives a case-mix-adjusted clinical target level of staffing for the facility as a whole. The ratio of a facility's actual staffing level to its target staffing level is known as the "STRIVE ratio." For ease of exposition, we use the terms "STRIVE ratio" and "percent of clinical target" interchangeably.

Two caveats are important in interpreting the STRIVE ratio. First, many researchers and advocates believe that the STRIVE targets are substantially lower than the number of hours needed to provide high-quality care (Harrington et al., 2020), and therefore the ideal staffing level exceeds a 100% ratio. Indeed, the policy we study incentivizes increasing staffing up to 125% of STRIVE. Second, STRIVE ratios and the incentive payments we study do not distinguish between the hours of care provided by staff with differing levels of certification. Correspondingly, it is common to examine staffing levels separately for each staff type. For

example, CMS uses both the total STRIVE ratio and RN staffing levels specifically when evaluating nursing home staffing.

In addition to low staffing *levels*, there is also concern about high staffing *flows*. Staff turnover, especially among CNAs, is high, with most facilities having an annual CNA turnover rate exceeding 100 percent. High turnover of staff disrupts the care that residents receive and is associated with lower quality care (Gandhi et al., 2021; Loomer et al., 2022; Shen et al., 2023; Zheng et al., 2022)

2.2 Illinois Medicaid incentive payment reform

More than 60% of nursing home bed-days are paid for by Medicaid. Medicaid reimbursement formulas vary across states, but typically provide a per-diem amount for each Medicaid resident, with possible adjustments for factors such as geography or care needs.

On April 7, 2022, the Illinois legislature passed House Bill 0246 (HB0246), which aimed to increase staffing by changing how the state's Medicaid program reimbursed nursing facilities.[1] The largest component of HB0246 was a staffing level incentive payment for nursing homes. These incentive payments provided an additional $9 per Medicaid-resident-day for facilities achieving 70% of the clinical target and gradually increased to a maximum of $38.68 per Medicaid-resident-day for facilities achieving at least 125% of the target.[2] Crucially, the incentive payments were quite large compared to the base per-diem, which averaged $181.78 prior to the reform. Additionally, only 11.0% of Illinois facilities staffed above 125% prior to the reform, indicating that the upper threshold was rarely binding. Appendix B provides additional details on the timing and other components of HB0246.

Three additional points about the incentive payments are worth emphasizing. First, because the policy only increases Medicaid reimbursements, facilities with more Medicaid residents are more "exposed" to the payment reform and should therefore be more responsive. Second, because payments are based on staffing *levels* rather than *changes*, facilities with high levels of staffing receive large payments even if they would have had high staffing without the incentive payments. Finally, because the incentive payments do not distinguish between levels of nursing staff certification, a cost-conscious facility can achieve high staffing levels through CNAs rather than more expensive LPNs and RNs, and could even reduce expenditures on LPNs and RNs.

[1] Though the bill was formally signed into law on May 2022, we treat April 1 (i.e. the start of 2022Q2) as the "event date" because executive approval was virtually certain given that the governor supported the bill.

[2] The shape of the incentive schedule is shown in Figure 1a. Facilities staffing below 70% of the clinical target did not receive any incentive payment.

3 Data and empirical approach

3.1 Data

Our primary data are the Payroll-Based Journal (PBJ). These administrative microdata provide shift-level information on all direct care staff for the universe of nursing homes, including a facility-specific unique identifier for each worker, the number of hours worked that day, occupation (i.e., RN, LPN, or CNA), and whether the worker was paid as an employee or as a contractor. Over our sample period (2021Q1-2023Q2), these data contain 16.8 million nursing shifts for 702 Illinois facilities, and 359.2 million nursing shifts for 14,623 non-Illinois facilities.

The PBJ data derive from payroll records submitted quarterly by nursing homes to CMS that are used to assess facilities' staffing levels. Facilities typically export their submissions directly from their payroll software, and submissions are subject to audit risk. As such, PBJ data provide a particularly reliable and precise measure of hours worked. Reporting rates are very high: the average facility reported staffing data for 106.2 of 111.00 weeks in our analysis period. While our panel is not fully balanced, we show robustness to using a fully balanced sample in Appendix Section F.1. Additional details on the data and sample are in Appendix A.

Our main outcome measures are constructed at the facility-week level from the PBJ. In addition to constructing staffing measures for the facility as a whole, we also construct measures separately by staff role, full-time and part-time staff, and employees and contractors. The unique employee identifiers also allow us to track changes to individual employees' hours, as well as track facilities' hires and departures. This allows us to construct measures to decompose effects by the extensive margin (e.g., additional workers) and intensive margin (e.g., additional hours worked by existing employees). To ease interpretation of comparing effects across different-sized facilities, we scale these employee counts by the average daily resident census in the facility-week, which is also provided in the PBJ.

We supplement the PBJ microdata with quarterly data from Nursing Home Compare (NHC), a consumer-facing report card for each facility. Crucially, NHC provides a quarterly measurement of each facility's patient case mix, which we use to adjust staffing levels for the clinical needs of a facility's patients. We interpolate between quarter midpoints to arrive at our weekly clinical target staffing percentage outcome. NHC also contains additional facility characteristics—e.g. number of beds and location—that are used in our analysis. Finally, the NHC data also provide information on patient-centered health outcomes derived from federally-mandated quarterly patient health assessments that we use to study impacts on clinical outcomes in Appendix D.

Lastly, in order to examine heterogeneity in our results by facilities that are more and less reliant on Medicaid reimbursements, we use LTCFocus data to obtain the share of residents whose primary support was Medicaid at the time of the facility's 2019 annual survey.

3.2 Empirical approach

To identify the effects of the incentive payments, we use a difference-in-differences (DD) event study approach that compares staffing in Illinois facilities (the "treatment" group) to facilities in all other states ("control group"). Specifically, we estimate:

$$y_{it} = \sum_{\tau \neq -1} \beta^{\tau}(IL_i \times d_t^{\tau}) + \alpha_i + \alpha_t + \varepsilon_{it} \tag{1}$$

where i indexes facility and t indexes time (in weeks). α_i and α_t are facility and time fixed effects, respectively. The d_t^{τ} terms denote calendar-week dummies, and IL_i is an indicator for Illinois facilities. The coefficients of interest are the β^{τ} terms, which capture the differences in y_{it} between Illinois facilities and the rest of the United States. All estimates are normalized relative to one week before the reform (i.e., relative to $\tau = -1$). For ease of interpretation, we add the average outcome of the treatment group in the omitted period to all estimates in order to provide a sense of scale relative to typical outcome levels.

This approach captures the effect of the Illinois reform if the parallel trends assumption holds: that is, any average *differential* changes in y_{it} in Illinois relative to the rest of the United States are due to the policy reform. While this assumption is not testable, we can assess its plausibility by examining the trends in β^{τ} over the period preceding the passage of the reform. Little divergence in trends between Illinois facilities and facilities in the rest of the United States over this pre-treatment period bolsters confidence in the parallel trends assumption.

Our main approach uses data from April 1, 2021 ($\tau = -52$) through May 14, 2023 ($\tau = 59$).[3] The analysis period begins after Covid-19 vaccinations became available, avoiding the peak of the pandemic in nursing homes.[4] The post-treatment period begins on April 1, 2022 (a week before the reform's passage in the legislature) because the revised payments retroactively applied to staffing levels beginning on April 1, 2022. Moreover, facilities may have anticipated the reform's passage as it moved through the legislature.

Because the Illinois reform adjusts the per-diem Medicaid payments that facilities receive from the state, facilities that have a larger share of Medicaid residents have stronger

[3]Our sample period ends mid-quarter because the staffing target variable is measured quarterly, and we define weekly STRIVE ratios by interpolating the denominator between quarter midpoints.

[4]Appendix Section F.1 shows similar results for a longer pre-period that begins in 2020Q2.

incentives to increase staffing. Accordingly, we assess heterogeneity in the treatment effects by interacting the treatment effect indicators ($IL_i \times d_t^\tau$) with indicators for whether the facility has a high- or low- share of Medicaid residents, defined by whether a facility's share of Medicaid patients fell above or below the Illinois median in 2019 (58.3%).

In addition to presenting event study analyses, we also provide a "pooled" difference-in-difference estimate that summarizes the difference before and after the reform. Given potential anticipatory responses, as well as the time required to hire new workers or adjust schedules, the pooled DD estimates exclude one quarter on either side of the treatment date.

For our main analyses, we report heteroskedasticity-robust standard errors clustered at the facility-level, as this is the unit of analysis in our panel data. Appendix G provides results under alternative cluster schemes such as clustering at the state level, in addition to non-parametric block bootstrap and permutation procedures. These results indicate that facility-level clustering is generally more conservative than other approaches in this setting.

4 Results

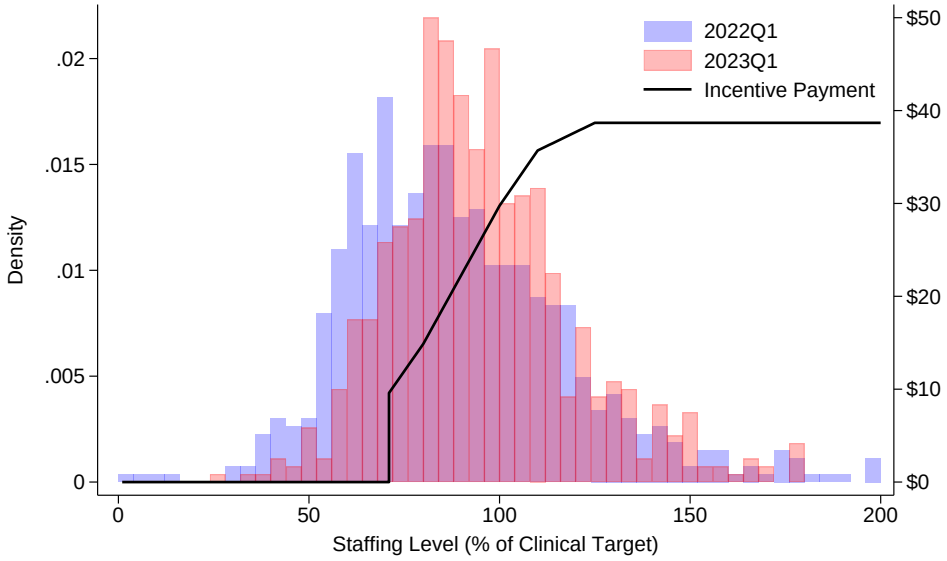
4.1 Effects of the reform

Figure 1 previews our main result. Panel (a) presents the target staffing distribution for facilities in Illinois in 2022Q1, the last quarter before the reform passed, as well as the distribution four quarters later in 2023Q1. Panel (b) presents the staffing distributions for all non-Illinois facilities in the same periods. The divergence between panels (a) and (b) summarizes our key result: there was a noticeable rightward shift in the Illinois distribution after the reform but no distinguishable change in non-Illinois facilities.

Figure 2 formalizes the intuition from Figure 1 in the event study specification from equation (1). Panel (a) shows staffing levels for the full sample. The stability of the β^τ estimates prior to the reform indicates that Illinois facilities were not on different staffing trajectories relative to the rest of the country before the staffing incentives were introduced. In the post-treatment period, we find a steady increase that levels off in 2022Q4, consistent with firms learning and adapting to the new incentives over the first few quarters. Comparing the pooled estimates for the post-period and the pre-period (excluding the quarter on either side of the treatment) indicates that the reform increased the staffing ratio by 5.35 percentage points. This increase is equivalent to moving from the 50^{th} to the 57.1^{st} percentile of the pre-reform distribution in Illinois.

The response in Figure 2a averages across firms with varying exposure to the reform. Crucially, while facilities' per-resident staffing levels were calculated using all of the facilities'

(a) Illinois facilities



(b) Non-Illinois facilities

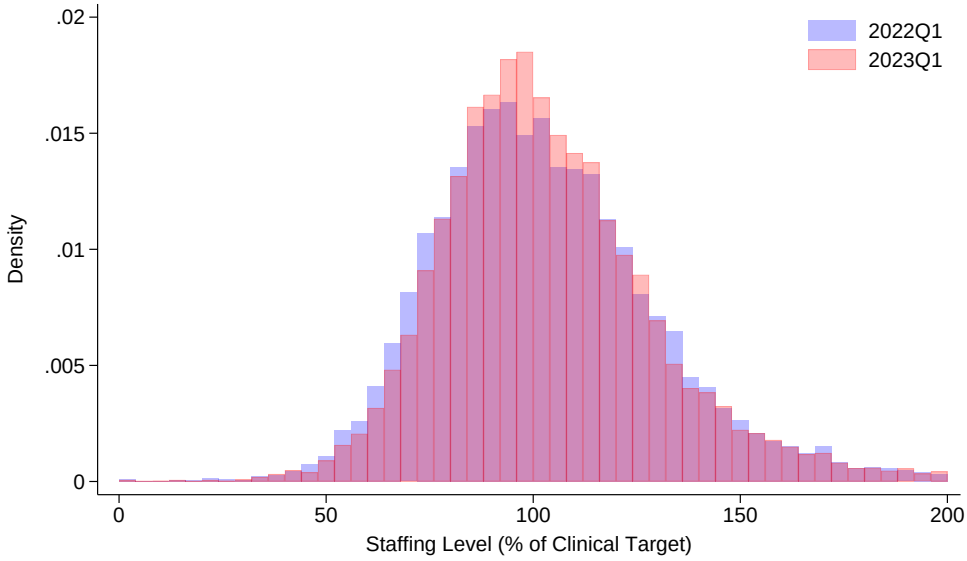


Figure 1: Comparison of staffing levels in 2022Q1 vs 2023Q1, Illinois and non-Illinois facilities

Notes: Figure plots histograms of facility-quarter staffing levels, expressed as a percent of the STRIVE target staffing level, for 2022Q1 (blue) and 2023Q1 (red). Panel (a) presents staffing levels for Illinois facilities; panel (b) presents staffing levels for non-Illinois facilities. Staffing levels exceeding 200% are excluded. Panel (a) overlays the reform incentive payment schedule (black line).

residents, without regard to payer, the incentive payments increased reimbursements *only for Medicaid residents*. Therefore, the staffing incentive payments created substantially stronger

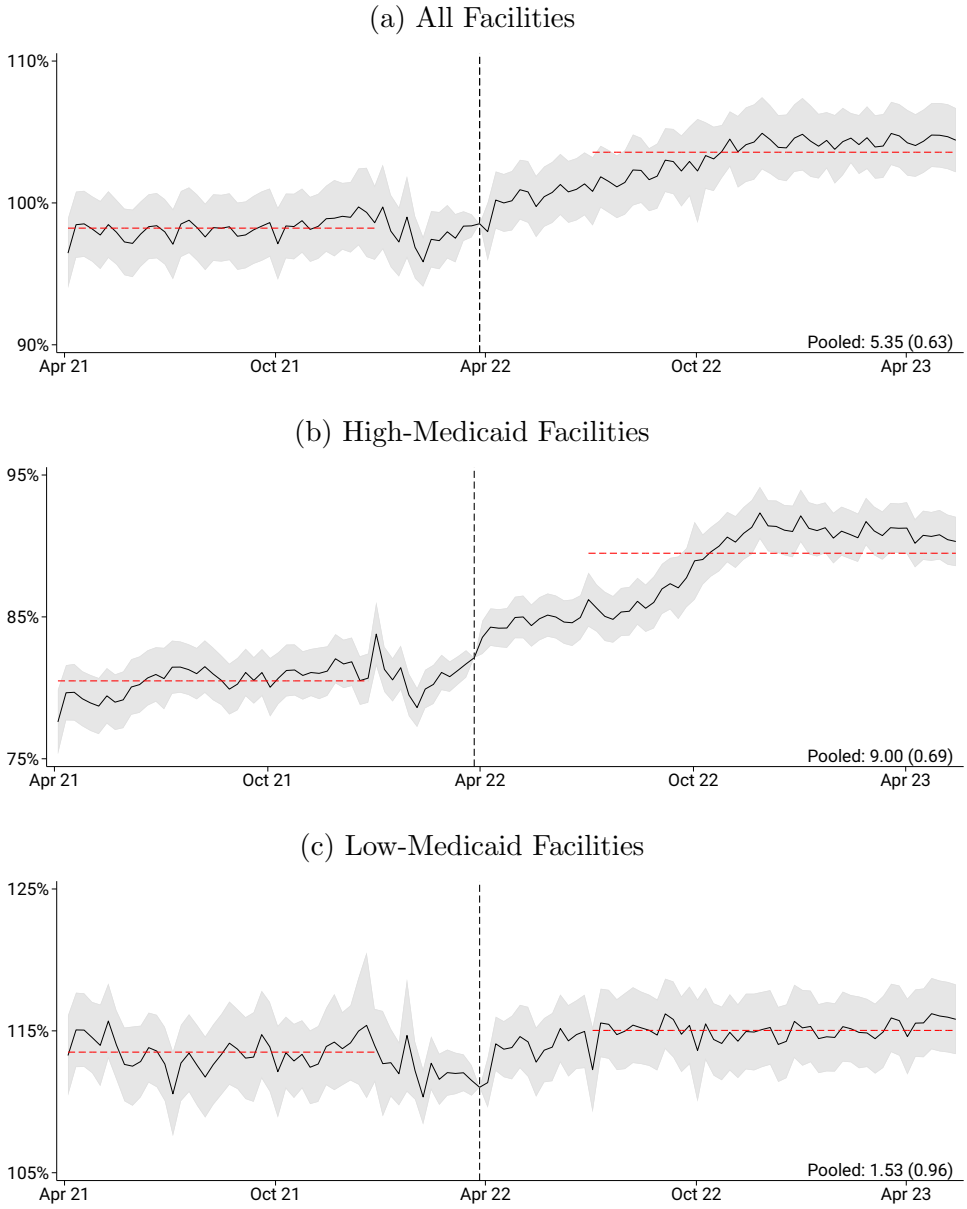


Figure 2: Staffing Levels (% of Clinical Target), by Medicaid Payer Share

Notes: Figure presents results from difference-in-difference event study regressions with each outcome centered around the mean value in Illinois during the week before the effective date. Gray area denotes 95% confidence interval with robust standard errors clustered by facility. N=4,083,670 facility-week observations corresponding to N=15,828 facilities. Dependent variable is total nurse (RN, LPN and CNA) staffing hours, expressed as a percent of the STRIVE target staffing level. The vertical line indicates the effective date of the reform: April 1, 2022. The red horizontal lines indicate pre-treatment and post-treatment averages, excluding the quarter prior and the quarter after the reform. The pooled estimate in the lower-right corner provides the difference between the post- and pre-treatment average coefficients. The standard error of this difference is reported in parentheses. High (low) Medicaid facilities defined as whether the facility had above (below) the median share of Medicaid residents in 2019 (58.3%).

financial incentives for facilities with more Medicaid residents. Accordingly, in the subsequent panels, we stratify facilities as either 'high-' or 'low-Medicaid,' corresponding to whether they had above- or below-median Medicaid shares.Two observations emerge: first, high-Medicaid facilities tend to have much lower staffing levels at baseline, which is consistent with facilities serving Medicaid populations being lower quality (Nyman, 1985b; Gertler, 1992; Rahman et al., 2014; Ching et al., 2015; Gandhi, 2023). Prior to the reform, the mean staffing at high-Medicaid facilities was 82.1% of the clinical target (Figure 2b), compared to 111.0% at low-Medicaid facilities (Figure 2c). Second, we find that, as expected, the effect of incentive payments was concentrated among high-Medicaid facilities: these facilities increased their staffing by 9.00 percentage points compared to just 1.53 percentage points in low-Medicaid facilities. Both the lack of pre-trends and the concentration of the effect in highly-exposed facilities strongly suggest that the effects we estimate are the result of the payment reform.

Because the incentive payments reduce the effective wage for marginal hours of labor, the staffing response provides an estimate of the own-wage elasticity of labor demand ($\epsilon = \left(\frac{\partial emp}{\partial wage}\right)\left(\frac{wage}{emp}\right)$). We calculate these elasticities for each firm in Appendix C. The average labor demand elasticity implied by these estimates is -0.142, squarely within the existing estimates and particularly consistent with others examining short-term responses in the United States (Lichter et al., 2015). However, this average elasticity masks considerable heterogeneity. For example we find that the average implied elasticity for high-Medicaid facilities is -0.200, compared to -0.097 for low-Medicaid facilities.

Just as high-Medicaid facilities faced stronger incentives to raise staffing at the margin, facilities faced differing incentives to adjust staffing depending on their initial staffing levels. Facilities with very low baseline staffing faced strong incentives to improve to at least the 70% benchmark given the significant discontinuous jump from \$0 to \$9 in per-resident payments for achieving that level. On the other extreme, facilities that were operating at very high staffing levels (above 125%) faced no marginal incentives because the reimbursement formula is flat above 125%. Facilities between 70% and 125% faced a relatively consistent marginal incentive to increase staffing.

Figure 3 explores this heterogeneity by presenting estimates of the treatment effect at each point of the pre-treatment staffing distribution. To do this, we allow the treatment effect to be a cubic polynomial in a facility's pre-treatment staffing level.[5] We follow Acemoglu and Finkelstein (2008) in accounting for heterogeneous Medicaid exposure by interacting the binary treatment with Medicaid share.[6] Accordingly, the curve in Figure 3 can be interpreted

[5]Appendix Figure E.5 presents comparable estimates from a piecewise quadratic regression, with different curves fit over the regions of the incentive payment schedule.

[6]This implicitly assumes a linearity of treatment effect in Medicaid share, as well as a stronger form of parallel trends (Callaway et al., 2024).

as the treatment effect for a facility with only Medicaid residents.

Figure 3 indicates that the largest staffing increases occurred among facilities with low staffing prior to the reform. The effect size declines steadily with pre-treatment staffing levels and, as predicted, is statistically indistinguishable from zero for facilities above the 125% threshold.

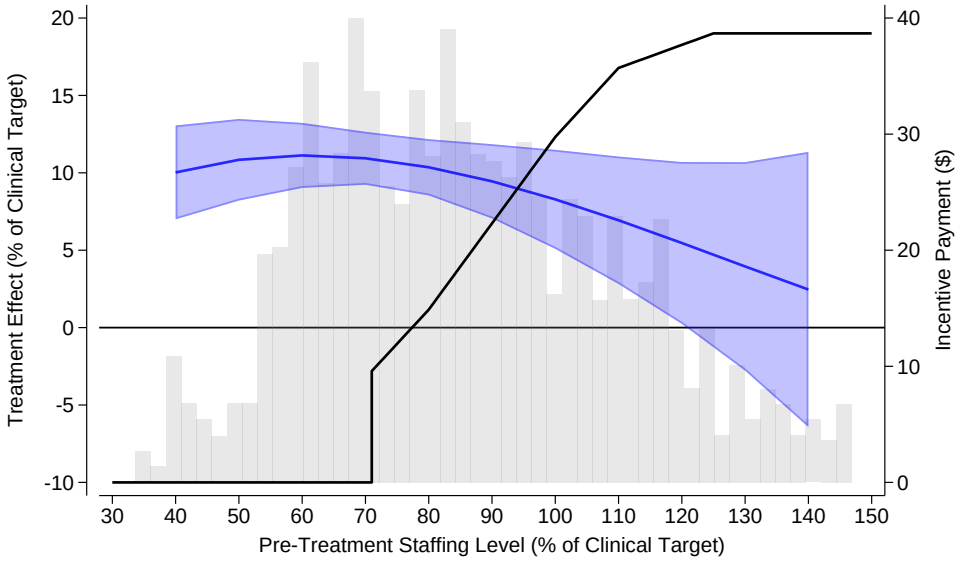


Figure 3: Heterogeneity by Pre-Treatment Staffing Level

Notes: Figure presents treatment effects across the pre-treatment staffing level distribution. Treatment effects are calculated using cubic polynomials in pre-treatment staffing. Treatment is assumed to scale linearly in Medicaid share. As with all pooled estimates, we exclude the quarters immediately before and after the reform. Shaded area denotes 95% confidence interval with robust standard errors clustered by facility. Baseline staffing distribution in gray histogram; black line denotes the incentive payment schedule.

Figure 4 focuses on high-Medicaid facilities and examines various margins of staffing adjustment that may have generated the overall increase in staffing. Panels (a), (b), and (c) examine the contributions of CNA, LPN, and RN nursing staff to the overall staffing ratio. By far the largest contributor to the overall staffing growth comes from higher CNA staffing: the CNA component of the STRIVE ratio rises by 6.64 percentage points, compared to 1.26 for LPNs and 1.10 for RNs. As firms are rewarded for their total staffing and not their "skill-mix," increasing hours primarily of the lowest-cost staff suggests that facilities were cost-conscious in their approach to obtaining greater staffing incentive payments. These changes alter the average skill-mix: the reform increased the share of hours that come from CNAs by 1.74 percentage points (Panel (d)). Importantly, however, the estimates imply that this shift occurs primarily through *additional* CNA employment and not from cutting or replacing highly certified staff.

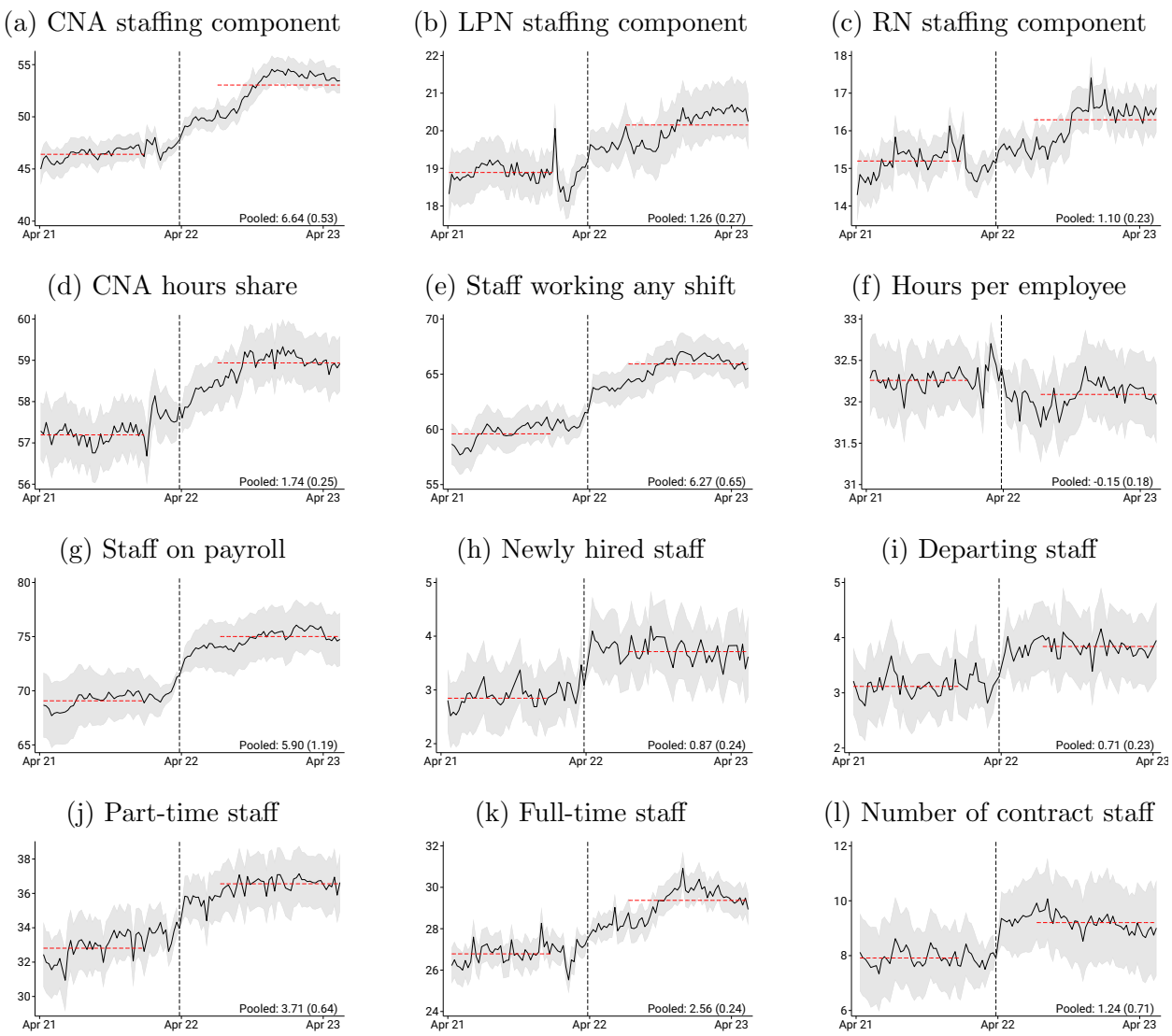


Figure 4: Margins of staffing adjustment, high-Medicaid facilities

Notes: Figure presents results from difference-in-difference event study regressions with each outcome centered around the mean value in Illinois during the week before the effective date. Sample limited to facilities with above the median share of Medicaid residents in 2019 (58.3%). Employee counts are scaled by the facility's average daily resident census (per 100 residents). Gray area denotes 95% confidence interval with robust standard errors clustered by facility. The vertical line indicates the effective date of the reform: April 1, 2022. The red horizontal lines indicate pre-treatment and post-treatment averages, excluding the quarter prior and the quarter after the reform. The pooled estimate in the lower-right corner provides the difference between the post- and pre-treatment average coefficients. The standard error of this difference is reported in parentheses.

We also examine whether the observed staffing increases result from the extensive margin—i.e., increases in the number of staff—or the intensive margin—i.e., greater hours worked by existing staff. Panel (e) shows that the number of staff who worked at least one shift in a given week rose sharply following the reform: 6.27 additional employees per 100 residents

working in a given week. Panel (f) finds a small and statistically insignificant decrease in hours per employee, indicating that extensive margin responses are driving the overall staffing increase.

These extensive margin changes could be driven by increasing either hiring of new staff or retention of existing staff. Panels (g) and (h) suggest a strong role for additional hiring, as both the number of staff on payroll and the number of new hires (employees working their first week at the facility) rise immediately after the incentive payments take effect.[7] In contrast, Panel (i) suggests that the extensive margin changes are *not* due to an increase in retention, as the weekly number of departing staff increased following the reform.

Panels (j) and (k) examine how the change in employment was distributed across part-time ($<$ 35 hours in a given week) and full-time workers ($\geq$ 35 hours in a given week). We find increases in both part-time and full-time work, with an additional 3.71 part-time employees per 100 residents (Panel (j)) and an additional 2.56 full-time workers per 100 residents (Panel (k)). Finally, we examine the number of staff who are employed by contract agencies, rather than directly employed by the facility. Contract work is common in the nursing home industry: prior to the reform, the average high-Medicaid facility in Illinois staffed 7.56% of their hours with contract staff. Panel l shows that contract staff explain just part of the staffing increase: the number of contract staff increased by 1.24 employees per 100 residents. In Appendix Figure E.4, we show that these changes resulted in slight compositional shifts towards more part-time and contract workers.

In Appendix D, we investigate whether these changes in staffing were associated with improvements in clinical outcomes. Given the well-established link between staffing and quality of care established by the prior literature, we would expect improvements in clinical outcomes that are associated with staff. In line with this prediction, we find modest improvements in resident health.

4.2 Contrast with an unincentivized rate increase

The incentive payments we study are relatively unique in explicitly connecting reimbursement to staffing levels. In doing so, the reimbursement schedule directly incentivizes higher staffing levels. In contrast, most other reforms increase reimbursement rates without incentives. Industry advocates typically argue that even unincentivized rate increases will alleviate financial constraints and allow greater spending on staffing. The academic literature further argues that unincentivized rate increases can improve quality by increasing competition over Medicaid patients. Most notably, Hackmann (2019) estimates a structural model of the in-

[7] That facilities were able to hire additional workers contrasts with industry rhetoric that staffing levels cannot be increased because no workers are available (AHCA, 2023).

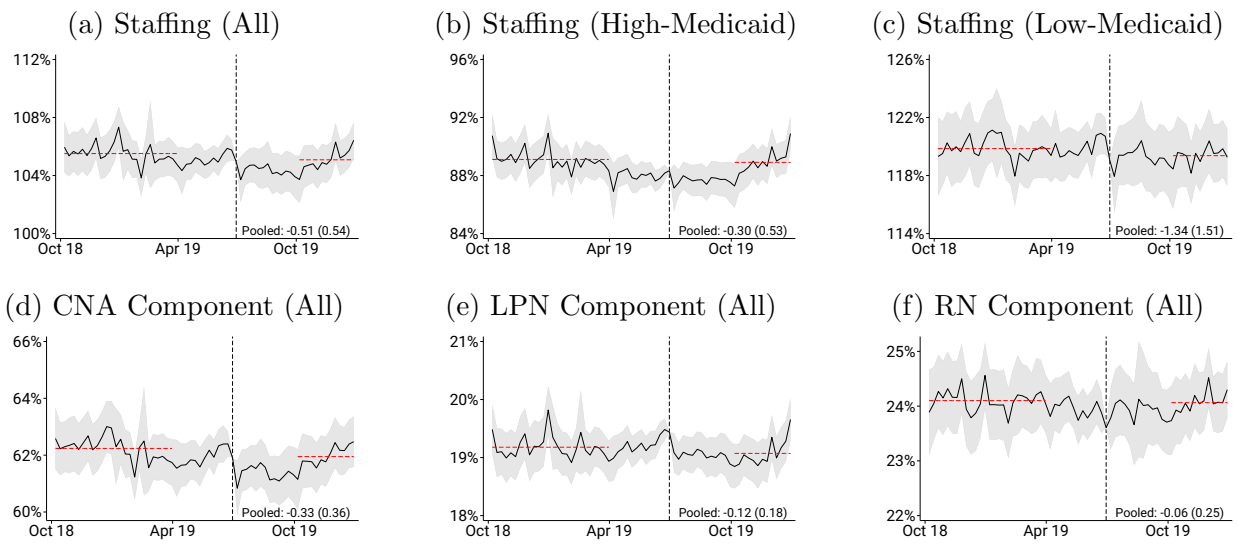


Figure 5: Event study of staffing levels before and after 2019 reform

Notes: Figure presents results from difference-in-difference event study regressions with each outcome centered around the mean value in Illinois during the week before the effective date. Gray area denotes 95% confidence interval with robust standard errors clustered by facility. For the top row, the dependent variable is total nurse (RN, LPN and CNA) staffing hours, expressed as a percent of the STRIVE target staffing level, for all facilities (Panel (a)), high-Medicaid facilities (Panel (b)), and low-Medicaid facilities (Panel (c)). For the bottom row, the dependent variable is CNA, LPN, and RN staffing separately, expressed as a percent of the STRIVE target staffing level, for all facilities.The vertical line indicates the effective date of the rate reform: July 1, 2019. The red horizontal lines indicate pre-treatment and post-treatment averages, excluding the quarter prior and the quarter after the reform. The pooled estimate in the lower-right corner provides the difference between the post- and pre-treatment average coefficients. The standard error of this difference is reported in parentheses.

dustry that implies that an across-the-board 10% increase in Medicaid reimbursement would yield a 8.7% increase in staffing.

In order to distinguish whether the large effects we estimate in Section 4.1 are attributable to the sloped nature of the staffing incentive or simply to increasing the average rate, we examine an unincentivized Illinois rate reform from 2019. This 2019 reform increased the average Medicaid per-diem by $16.51 (10.91%) through an across-the-board rate increase and a facility-specific increase based on each facility's *historical* costs. Crucially, neither component was tied to facilities' staffing levels or even to other contemporaneous measures of quality or expenditures.

We analyze this reform analogously to equation (1) using data from October 1, 2018 ($\tau = -52$) to January 1, 2020 ($\tau = 26$). The treatment date for this policy ($\tau = 0$) is July 1, 2019, the effective date of the 2019 reform. The shorter post-period in this analysis avoids the start of the Covid-19 pandemic.

The results in Figure 5 dramatically differ from the patterns shown in Figure 2. In

contrast to the 2022 reform that directly tied reimbursement to staffing levels, the 2019 reform led to no discernible change in any dimension of staffing. The inefficacy of the 2019 reform suggests that simply raising reimbursement rates is not effective at increasing staffing. The comparison between the two reforms highlights the importance of directly connecting reimbursement policies to current staffing levels if policymakers' goal is to increase employment.

4.3 Assessing the cost of the 2022 staffing incentive payments

Section 4.1 demonstrated that the 2022 incentive payments successfully raised nursing home staffing levels. To evaluate cost-effectiveness, we benchmark the cost of the incentive payments against the market price of the additional staffing induced by the rate reform. Doing so allows us to evaluate the extent to which the incentive payments were passed through as greater spending on staffing rather than spent on other inputs or otherwise captured by the firm.

Data from the Illinois Department of Healthcare and Family Services (HFS) indicate that for the first quarter of 2023 (the last full quarter of our analysis period), the average incentive payment to a facility was $93,338. To assess the size of this transfer compared to the amount of increased staffing, we calculate the market price of the additional staff hours induced by the policy. To do this, we first multiply the treatment effect estimates $\hat{\beta}$ (expressed as the ratio of actual staffing to the clinical target) by the clinical targets for each facility to obtain the marginal CNA, LPN, and RN hours induced by the reform for each facility. Appendix Figure E.8 shows the distributions of marginal hours both overall and by Medicaid share.

We then estimate the average hourly market cost of an additional labor hour for CNAs, LPNs, and RNs using total compensation (wage plus fringe benefits) data from the 2022 federal Healthcare Cost Report Information System (HCRIS). In Illinois, an additional CNA hour costs $23.40, compared to $38.52 per LPN-hour and $45.19 per RN-hour. These market prices can then be used to determine the extent to which the incentive payments were passed through to generate higher staffing. We perform these calculations separately for high- and low-Medicaid facilities, summarized in Appendix Table E.2.

On average, the payment incentives induced an increase in staffing worth $36,448 at market wages each quarter. Given that the quarterly cost to the government of incentive payments for the average facility was $93,338, this implies a passthrough of 39.0%—i.e., on average, a dollar of spending on staffing incentive payments resulted in an additional 39.0¢ of staffing. For high-Medicaid facilities, the balance is more favorable to the government: facilities received a mean incentive payment of $93,594 which generated staffing increases valued

at $80,497, implying a passthrough rate of 86.0%. For low-Medicaid facilities, however, the passthrough was just 3.56%. These facilities received large payments—$93,146 on average—but negligible staffing increases valued at only $3320 on average.

This divergence in cost-effectiveness stems from two forces. First, as indicated by the results in Section 4.1, the incentive payments increased staffing much less in low-Medicaid facilities. Second, the per diem incentive payments for low-Medicaid facilities tended to be *larger* due to high baseline staffing levels, enough so that the overall payments (i.e., the daily incentive payments multiplied by the number of Medicaid days) were nearly identical to those for low-Medicaid facilities ($93,594 vs. $93,146 in 2023Q1).

Such patterns reflect a well-understood but often overlooked dynamic: paying for quality may involve substantial transfers to inframarginal facilities that already had high staffing. In many settings, this implies that a significant share of each public dollar spent does not change behaviors, and therefore yields no concrete benefits. In the nursing home setting it highlights a regressive pattern of these incentive payments: due to their greater baseline staffing, facilities that serve few Medicaid patients receive total incentive payments similar to the facilities that serve a large number of Medicaid patients. This inefficiency could be counteracted by targeting changes rather than levels—i.e., by rewarding *improvements* in staffing—but this may not always be practically or politically feasible.

It is also important to note that the additional staffing induced by the Medicaid reform is likely enjoyed by *all* residents, not only those whose stays were covered by Medicaid. Nursing homes are legally prohibited from varying quality of care by payer, and previous research has shown that staffing is empirically a common good enjoyed by all patients at a facility (Grabowski et al., 2008). Accordingly, the passthrough calculation in this section compares the benefits to all payers (including Medicare and private-pay patients) against the cost paid by Medicaid. A narrower cost-effectiveness analysis might consider only the benefits to Medicaid residents (i.e. multiplying each facility's additional staffing hours by its Medicaid resident share to obtain the number of new staffing hours serving Medicaid patients assuming the new staffing hours are distributed equally across all residents). This narrower calculation yields lower passthrough rates of 69.3% (high-Medicaid) and 1.9% (low-Medicaid). That Medicare and private payers also benefited from the incentive payments relates to a large literature on cross-payer spillovers in health care (e.g. Clemens and Gottlieb, 2017; Einav et al., 2020; Barnett et al., 2023). In such circumstances, a payer that considers only the benefits to their patients would understate a policy's social benefits and may therefore be reluctant to undertake similar policies in the future.

5 Conclusion

In settings where the government pays for services, connecting reimbursement schedules to staffing levels can be an effective lever to reduce staffing shortages. In the nursing home sector, we find that tying Medicaid reimbursement to a targeted staffing level increased staffing by 5.35 percent of the clinical target overall, and 9.00 percent among facilities serving a relatively large share of Medicaid residents. These large effects contrast with the negligible changes following a previous unincentivized rate reform. The difference between these two reforms highlights that funding formula should be explicitly connected to the policy goal.

Our results also show that most of the increase in staffing was due to increased work in occupations that typically receive low wages, namely new staff working part-time as CNAs. These patterns are consistent with firms responding cost-consciously. Correspondingly, our findings suggest that if policymakers wish to increase staffing among more costly workers—such as more highly-certified or highly-tenured workers—the incentive payments may need to target these workers directly. Finally, we find that while facilities with the largest responses to the policy were those serving the largest share of lower-income, Medicaid residents, most dollars went to firms that had high staffing levels before implementation and that did not increase staffing.

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