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Is Managed Care Effective in Long-term Care Settings?
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ABSTRACT

Nursing homes face unique financial incentives that encourage under-investment in onsite clinical capabilities and overreliance on hospitals to triage and care for residents with dementia, contributing to high levels of health care spending for this population. A proposed solution to align incentives are Institutional Special Needs Plans (I-SNPs), which combine capitated financing with plan-provided onsite clinician presence. Using 12 million resident-quarters of data from 2016-2022, we exploit the timing of nursing homes' I-SNP contracting to instrument for plan enrollment and estimate causal effects on hospitalization and other health outcomes. We found that I-SNP enrollment reduced quarterly hospitalization rates by 3 to 4 percentage points, which equates to one third of hospitalizations relative to the sample mean. We do not find consistent evidence of an impact on other health outcomes and quality of care indicators.

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1. Introduction

Nursing homes provide care to about one million residents on an annual basis, the majority of which have some sort of dementia (Gaugler et al. 2014). A longstanding concern for policymakers is the consistently substandard quality of care in these facilities and frequent overuse of intensive services, particularly hospitalizations which cost the federal government nearly $15 billion annually (Tyler et al. 2022). High hospitalization rates in the nursing home setting have been linked to conflicting provider incentives stemming from a fragmented system of financing and governing policies. Over 95% of nursing homes provide Medicare-financed post-acute rehabilitation and skilled nursing care in addition to long-term care, which is primarily paid for by Medicaid. To qualify for post-acute care payments, residents enrolled in traditional Medicare must be hospitalized for at least three days. In 2022, the post-acute care margins for nursing homes were 22% compared to an overall margin of -1.3% when considering all payers. Due to this substantial difference in profitability and existence of the '3-day rule', nursing homes are not incentivized to invest in on-site clinical care and instead rely on hospitals to provide skilled clinical care to long-stay residents with injuries or illness.

Managed care models hold significant promise for addressing high spending in the nursing home setting. Consistent with broader national trends, the share of nursing home residents enrolled in Medicare Advantage (MA) plans has steadily increased (Jung et al. 2018). Unlike traditional (i.e., fee-for-service [FFS]) Medicare, MA plans operate under a capitated payment system and thus internalize the costs of clinical care. As such, plans are incentivized to actively be involved in the care delivery process and reduce excess acute care. For instance, MA benefit design may waive the need for a hospitalization to pay for post-acute care in a nursing home. Despite this, MA enrollees are often steered towards worse quality nursing homes (Meyers et al. 2018) and have high rates of disenrollment to traditional Medicare following a nursing home stay (Rahman, Keohane, et al. 2015; Goldberg et al. 2017). This adverse selection associated with disenrollment complicates the estimation of the causal effects of MA enrollment on health outcomes for nursing home residents.

In this paper, we examine the impact of enrollment in Institutional Special Needs Plans (I-SNPs) on health outcomes, primarily focusing on hospitalizations, for nursing home residents with ADRD. I-SNPs are a specific type of MA plan designed exclusively for individuals certified as requiring facility-based long-term care. Like other MA plans, I-SNPs receive capitated payments from Medicare, which creates incentives to reduce costly care among nursing home residents. However, unlike conventional MA plans, I-SNPs are required to develop and implement a Medicare-approved model of care. The most prolific I-SNP is operated by United HealthCare (UHC), which as a part of its model of care places insurer-employed nurse practitioners in nursing homes to provide in-house care coordination and to assist with treating acute illnesses in place. Such plan features suggest that I-SNPs are well-suited towards addressing the health needs of nursing home residents with ADRD while also addressing inefficiencies in care delivery. The share of long-stay nursing home residents enrolled in I-SNPs quadrupled between 2006 and 2021, from 2.2 percent to 8.8 percent (Chen et al. 2024). However, the impact of enrollment in I-SNPs among long-stay nursing home residents with ADRD remains unclear.

This study contributes uniquely by providing rigorous causal evidence on the impact of I-SNP enrollment on hospitalizations among nursing home residents with ADRD. We analyzed comprehensive Medicare claims and nursing home assessment data for each quarter of calendar years 2016 through 2022. To address potential selection into I-SNPs by individuals and selective contracting with I-SNPs by nursing homes, we use a nursing home fixed effects models combined with an instrumental variables (IV) strategy. Specifically, we use nursing homes' initiation of I-SNP participation as an exogenous source of variation. This identification strategy relies on temporal variation in residents' opportunities to enroll in I-SNPs prompted by the entry of these plans into nursing homes, allowing us to isolate causal estimates from selection effects. We show that I-SNP enrollment increases sharply after one becomes offered in a nursing home, but no evidence of underlying trends in health status correlated with I-SNP initiation.

Results indicate that there are significant reductions in hospitalization rates following I-SNP enrollment, with slightly larger effects for residents who switched to an I-SNP from FFS Medicare compared to those who switched to an I-SNP from a conventional MA plan. Additionally, our results highlight important distinctions between the predominant UHC I-SNP model, which had more pronounced effects on hospitalizations, and other I-SNPs which are disproportionately driving recent enrollment growth. Furthermore, our study provides novel insights into the temporal dynamics of I-SNP impacts, showing substantial improvements over time (or "maturity effects") in nursing homes' ability to reduce hospitalizations, while identifying minimal spillover effects on residents not directly enrolled in I-SNPs.

The remainder of this paper is organized as follows. Section 2 provides background context, detailing the structure of long-term care financing in the U.S., emphasizing specific challenges faced by nursing home residents with dementia under TM and the role of MA, and describes prior evaluations of the I-SNP program. Section 3 describes our data sources, study cohort selection criteria, and primary measures, including our operationalization of I-SNP enrollment and hospitalization outcomes. Section 4 outlines our empirical strategy. Section 5 presents our empirical findings. Finally, Section 6 summarizes and contextualizes study findings, describes limitations, and discusses future research directions.

2. Background

2.1 Dementia care in the United States

Alzheimer's disease and related dementias (ADRD) impose significant public health and economic burdens, particularly as the population ages. ADRD are a set of conditions characterized by cognitive decline significant enough to interfere with daily activities and caused by a variety of underlying disease processes, the most common of which is Alzheimer's disease. Currently, an estimated 6.9 million Americans aged 65 and older are living with dementia, with projections suggesting this figure could nearly double to 13.8 million by 2060 ("2024 Alzheimer's Disease Facts and Figures" 2024). The economic implications of dementia are large; in 2024, about 16% of total Medicare and Medicaid spending was on ADRD-related care (Williams et al. 2025; "2024 Alzheimer's Disease Facts and Figures" 2024). A significant share of ADRD health-related spending is on long-term care. For instance, close to 80% of US nursing homes residents have ADRD or some form of significant cognitive impairment (Gaugler et al. 2014). Given the high health risk of individuals with ADRD and large amount of dollars at stake, it is critical to promote policy to ensure efficient and effective health care use.

2.2 Long-term care in nursing homes

Long-term care in the US is delivered across multiple settings and by multiple providers. What distinguishes the US long-term care sector from that of other nations is its financing and reliance on a historically low-quality nursing home system, discussed in detail below. Direct insurer spending on long-term care totals about $415 billion annually, including close to $250 billion in Medicaid expenditures (Chidambaram and Burns 2024). Out-of-pocket spending totals close to $100 annually just for individuals with ADRD, not counting the costs of informal caregiving ("2024 Alzheimer's Disease Facts and Figures" 2024). Although Medicare does not directly pay for long-term care, it internalizes the costs of poor delivery that leads to excess outpatient and inpatient care for elderly and chronically disabled long-term care users. The earliest baby boomers, aged 79 years in 2025, are now reaching a period coinciding with increased demand for long-term care. Thus, the already expensive burden of long-term care to caregivers and taxpayers will heighten, necessitating the need for cost-containing and welfare maximizing policies.

Individuals with the most intensive long-term care needs (i.e., continuous assistance with medical and personal care) receive care in approximately 15,000 nursing homes nationwide. About 40% of all long-term care spending is spent on nursing home care. Nursing homes are also a critical site of care for individuals with ADRD; an estimated 78% of residents have ADRD or some form of significant cognitive impairment. Despite the health status of individuals with ADRD, who are at elevated risk for critical illness, hospitalization, and mortality, quality of care in nursing homes is persistently poor. Nursing homes are also a significant source of excess spending on ADRD, as multiple previous studies have documented persistently high rates of hospitalization among their residents (Intrator et al. 2007; Carter and Porell 2005) . Although hospitalizations can be life-saving, they are often avoidable and place residents at risk for iatrogenic diseases and delirium, which are expensive and potentially fatal complications (Inouye et al. 2014; Kosar et al. 2017). ADRD is a terminal diagnosis, and the benefits of hospitalization are even more clinically dubious at the end of life. Yet about 12% of residents with advanced dementia are hospitalized within 30 days of their death (Gozalo et al. 2011). Importantly, in-house skilled care provision may be an under-used alternative to acute care for nursing home residents.

Limited and fragmented financing for nursing homes has consistently been described as the source of their low quality. Medicaid is the predominant payer of nursing home services, but is also by far the least generous. Medicaid reimbursement rates for long-term care have been reported to be below the cost of providing care in most states (Mor et al. 2004). As a result, nursing home quality in the US is highly segregated by payer mix (Mor et al. 2004; Kosar et al. 2023). In addition, Medicaid only pays for basic long-term care services (i.e., personal care assistance and room and board) while Medicare covers the large remainder of health service needs (i.e., primary, acute, post-acute, and hospice care). Thus, historically neither Medicaid nor nursing homes internalize savings from reducing hospitalizations or investments in on-site clinical care.

Fragmented financing also subjects nursing homes to misaligned policies that are linked to both poor outcomes and excess spending. Over 95% of nursing homes operate as skilled nursing facilities (SNFs) that provide post-acute care. Because Medicare reimbursement rates for post-acute care exceed those provided by Medicaid for long-term care, nursing homes have incentives to hospitalize residents and attain higher-margin post-acute care payments (Grabowski 2007). On the Medicaid side, bed hold policies exacerbate perverse hospitalization incentives. In most states, Medicaid pays nursing homes a per diem rate to hold a resident's bed when they are hospitalized for the purpose of ensuring residential continuity. However, hospitalization rates have become higher due to bed hold policies (Intrator et al. 2007; Unruh et al. 2013).

2.3 The growth of Medicare managed care (Medicare Advantage) and special needs plans.

Although Medicare Advantage (MA) has been consistently growing since the passage of the Medicare Modernization Act in 2003, enrollment in MA has accelerated over the last decade. In 2024, 54% of Medicare beneficiaries were enrolled in an MA plan, up from 31% a decade earlier (Freed et al. 2024). In MA, insurers receive risk-adjusted per member per month payments by the Centers for Medicare and Medicaid Services (CMS) to finance the delivery of care to enrollees. Under capitation, incentives to reduce utilization are strong and may lead to reductions in care, wasteful or not. Although most analyses of MA enrollee utilization are cross-sectional, there is more robust evidence indicating that lower utilization in MA is not simply a product of favorable selection and does not lead to increases in mortality (Duggan et al. 2018).

Although MA enrollment levels among nursing home residents have lagged that of the general Medicare population, rates are beginning to converge (Jung et al. 2018); as of 2021, about 32% of long-stay nursing home residents were enrolled in MA. Close to 42% of MA-enrolled nursing home residents were enrolled in some type of special needs plan (SNP). SNPs are MA plans that are distinguished by having enrollment restricted to specific types of high-needs Medicare beneficiaries. Since SNP enrollees have high health risk, CMS requires SNPs to submit a model of care that must be approved by the National Committee for Quality Assurance. There are three types of SNPS: Dual Eligible SNPs (D-SNPs), Chronic Condition SNPS (C-SNPs), and Institutional SNPs (I-SNPs). While industry leaders and CMS have promoted SNPs broadly as innovative solutions within Medicare Advantage, rigorous evidence evaluating their effectiveness—especially distinguishing among plan types—is limited.

2.4 Institutional Special Needs Plan (I-SNP) as an alternative payment and long-term care delivery model.

Of the three types of SNPs, I-SNPs exclusively enroll individuals that require institutional long-term care, and plan members almost exclusively consist of nursing home residents. Like other MA plans, the per member per month payments from CMS are an underscoring feature that incentives the reduction of expensive forms of care. A second critical feature of I-SNPs is their presumably more nursing home-focused model of care, which distinguishes this plan type from both conventional MA plans and other SNPs. Although the Medicare-approved model of care may vary across I-SNPs, as we show in Figure 1, the majority of I-SNP enrollees are in a plan administered by United Healthcare (UHC), known as the United Healthcare Nursing Home Plan (UHC-NHP) or Optum I-SNP.

The UHC-NP model of care is predicated on the "Evercare" long-term care model, which was licensed as an insurance plan through a demonstration project in 1994 (Brummel-Smith et al. 2000). Evercare/UHC-NP has three major components. First, the plan directly employs advance practice clinicians (namely, nurse practitioners) and deploys them to nursing homes with the stated goals of improving care coordination with primary care teams and other facility staff, treating acute illnesses in place, and improve advance care planning. Second, when enrollees have skilled nursing needs, the plan does not require a three-day hospitalization as in Traditional Medicare and many conventional MA plans. Instead, UHC-NP pays Part A rates to nursing homes for the treatment of acute illness in-house. Third, some of the savings from reduced hospitalizations are shared with the contracting nursing home. Thus, incentives to hospitalize I-SNP enrollees are not only be reduced due to capitated MA payments, but also by the model of care more directly.

I-SNP enrollment levels and plan offerings have grown substantially. Between 2006 and 2021, the proportion of nursing home residents enrolled in an I-SNP increased from 2% to 9%. During the mid-2010s, both the number of I-SNP plans and number of I-SNP enrollees more than doubled. Although UHC-NP accounts for the majority of enrollees, recent growth in I-SNPs has been driven by other types of plans that may have different models of care. In 2022, 42% of I-SNP enrollees were enrolled in an I-SNP other than UHC-NP, up from 20% in 2016.[1]

2.5 Existing literature on effectiveness of I-SNPs

The features of UHC-NP and other I-SNPs would seemingly be beneficial to nursing home residents with ADRD, who require greater care coordination and support to navigate treatment decisions as ADRD progresses. On the other hand, capitated financing may lead to reductions in necessary care that may be devastating for high-health risk nursing home residents. However, the existing evidence base pertaining to the health effects of I-SNP enrollment is small and methodologically limited.

Early studies of the Evercare demonstration found that plan enrollment conferred reduced hospitalization risk and lowered overall spending, but included data from nursing homes in just five markets during 1996 through 2000 (Kane et al. 2003; 2001; 2004). A more recent study documented fewer hospitalizations and emergency department use among enrollees of selected "mature" UHC I-SNPs in 13 states during 2014 through 2015 (McGarry and Grabowski 2019). Another paper (Chen and Grabowski 2025) examined nursing homes with matured I-SNP, defined as having at least 33.75% of Medicare long-stay residents enrolled in an I-SNP, on facility-level outcomes. Results indicate that mature I-SNP facilities experienced reductions in hospitalizations, pressure ulcers, and urinary tract infections. However, there were increases in antipsychotic use, falls, and physical restraints.

An important limitation of prior work, other than the aforementioned generalizability issues, is that selection bias is inadequately accounted for due to the use of cross-sectional designs. This is a particularly large concern as nursing homes do not randomly contract with or form their own I-SNPs, and residents are not randomly assigned to I-SNPs. It is also unclear how selection bias may impact estimates of the association between I-SNP enrollment and outcomes directionally, for reasons we discuss in section 4.2. More recent work by Chen and Grabowski acknowledges the potential for selection bias, but did not estimate the effect of an individual's I-SNP enrollment on health outcomes. In addition, their focus is on the impact of mature I-SNPs, however maturity can itself be an outcome (i.e. an I-SNP may mature in nursing home if it has

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[1] The calculations in this paragraph were derived from publicly available SNP enrollment reports, available at https://www.cms.gov/data-research/statistics-trends-and-reports/medicare-advantagepart-d-contract-and-enrollment-data/special-needs-plan-snp-data: We used the January enrollment report for each year.

the initial success with reducing hospitalization rates, implying endogeneity). Another limitation of past work is a lack of attention to more recent I-SNP models, which account for a large share of I-SNP growth since 2016 (discussed more in section 3.3). These limitations warrant a comprehensive examination of the effect on I-SNP enrollment on individual's health outcomes and distinct consideration of the efficacy of UHC-NHP versus more recently formed I-SNP models.

3. Study Data, Cohort, and Main Measures

3.1 Data Sources

This study relies on four primary sources of Medicare administrative data. First, the Medicare Beneficiary Summary File (MBSF) is an enrollment listing of all currently and previously enrolled Medicare Beneficiaries that includes data on demographics, monthly Medicaid and MA participation, and dates of death. Second, the Medicare Provider and Analysis Review (MedPAR) database is a comprehensive source of acute hospital claims for both Traditional Medicare (TM) and MA enrollees. Third, the Minimum Data Set (MDS) is a clinical assessment administered to all individuals admitted to government-certified nursing homes upon admission and serially thereafter until discharge or death. Fourth, the Public Use Medicare Advantage Files include detailed plan characteristics such as plans' names and linkable identifiers.

3.2 Cohort

Our study cohort includes all long-stay nursing home residents aged 65 and older with a diagnosis of Alzheimer's disease or related dementias (ADRD), observed between 2016 and 2022. Our unit of analysis is person-quarter, as long-stay nursing home residents are assessed at this interval via the MDS on a regular basis. We construct an unbalanced panel in which individuals contribute observations for each calendar quarter during which they met our criteria for long-stay residence in a nursing home, beginning with the first quarter of 2016 and ending with the last quarter of 2022.

We construct the cohort using the Residential History File (RHF) methodology (Intrator et al. 2011), which links Medicare claims and MDS assessments using dates of admission and discharge to determine daily care settings.[2] From this, we identify new nursing home admissions

[2] In brief, the RHF is an algorithm that links the dates of service of multiple sources of Medicare claims and assessment data to create a longitudinal history of health service utilization for each Medicare beneficiary. The rows of the resulting individual-episode level file include a 5-level setting classification: inpatient, nursing home, community

and follow beneficiaries until they have accumulated at least 100 days of nursing home residence. This 100-day threshold is commonly used in the literature to define long-stay status (Rahman, Tyler, et al. 2015; Rahman, Gozalo, et al. 2014). The date an individual reaches 100 cumulative days is defined as the index date of long-stay residence. We restrict the sample to person-quarters that begin after the index date and fall within calendar years 2016 to 2022. Quarters are excluded if the individual spent no time in a nursing home during that period or if the quarter included the individual's death.

We restrict the cohort to individuals with a documented ADRD diagnosis before their long-stay index date for two reasons. First, this restriction increases sample homogeneity and focuses the analysis on a clinically and policy-relevant population with high rates of potentially avoidable hospital use. Second, non-ADRD nursing home residents are less likely to be enrolled in Medicare and, therefore, less likely to have complete hospitalization data. ADRD diagnoses are identified using a combination of MedPAR claims and MDS assessments, following the approach outlined in (Meyers et al. 2022).

For most analyses, we stratify the cohort based on Medicare enrollment type—Traditional Medicare (TM) or Medicare Advantage (MA)—in the month of nursing home admission. At that time, individuals are not yet eligible for I-SNP enrollment, making this a natural baseline that serves three purposes. First, it allows us to distinguish the effects of I-SNP enrollment from the broader effects of MA participation, as all MA plans have incentives to reduce hospitalizations. Second, we expect treatment heterogeneity based on prior Medicare enrollment, as MA enrollees typically use fewer acute and post-acute services (either due to selection effects or plan-level utilization management), leaving less scope for further reductions. Third, while prior research suggests that lower hospitalization rates under MA compared to TM may reflect classification differences through the substitution of inpatient hospitalizations with outpatient observation stays (Beckman et al. 2023) or differences in diagnosis coding from risk adjustment gaming (Geruso and Layton 2020; Kosar et al. 2024), these concerns are less relevant when comparing I-SNP enrollees to other MA enrollees.

The final TM cohort comprises approximately 1.2 million individuals who were enrolled in TM at the time of nursing home admission and are observed over an average of 7.4 quarters,

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with home health, community without home health, and dead. These classifications are readily ascertainable for the entire Medicare population using CMS 100% data files that are typically distributed to researchers. For a detailed description of the RHF, see Intrator (2011).

resulting in a total of 8.7 million person-quarter observations (Table 1). The MA cohort includes 506,931 individuals who were enrolled in MA at the time of nursing home admission and are observed over an average of 7.0 quarters, resulting in 3.6 million observations. The total number of observed long-stay person-quarters increased from 1.8 million in 2016 to 1.9 million in 2019 before declining to 1.5 million in 2022—largely due to pandemic-related mortality and admission trends (Appendix Table 1). Over this period, the proportion of residents entering long-stay status while enrolled in MA increased steadily.

3.3 Exposure variable: Individual's I-SNP enrollment

We define I-SNP enrollment at the person-quarter level. An individual is classified as enrolled in an I-SNP in each quarter if they were enrolled in an I-SNP for at least two of the three months in that quarter. To achieve this classification, we linked monthly MA enrollment and plan identifiers from the MBSF to publicly available monthly SNP enrollment reports which also contain plan identifiers. To capture potential heterogeneity in effects across I-SNPs, we further distinguish between I-SNPs operated by UnitedHealthcare (UHC), the dominant I-SNP provider during the study period, and those offered by other MA contracts. This distinction is important for several reasons. Directly, it allows us to determine whether any shifts in outcomes are primarily attributable to UHC plans or reflect the effects of the I-SNP model at large. More broadly, it will become increasingly important in economic evaluations of Medicare Advantage to focus on UHC separately as it not only the predominant I-SNP insurer, but also the predominant Medicare Advantage insurer and by a large degree.

Figure 1 illustrates trends in I-SNP enrollment among long-stay nursing home residents from 2016 to 2022, stratified by Medicare enrollment status at the time of nursing home entry. Among those who entered a nursing home an MA enrollee, I-SNP enrollment rose from about 8% in 2016 to 13% by 2022. UHC I-SNP enrollment rates grew from 7% in 2016 to 10% in 2019 before declining slightly to 8% by 2022. Enrollment in non-UHC I-SNPs increased steadily over the same period, from under 2% in 2016 to roughly 5% in 2022. Similar trends were observed for residents who entered nursing homes as TM enrollees, however rates of I-SNP enrollment were substantially lower compared with those entering as MA enrollees. Importantly, these trends imply that the market share of UHC among I-SNP enrollees has declined over time. In 2016, over 80% of I-SNP enrollees were enrolled in a UHC plan, a figure that fell to approximately 65% by 2022.

3.4 Study outcomes

Our primary outcome of interest is the hospitalization rate among nursing home residents. This metric is historically high and represents a key potential source of cost savings that I-SNPs should theoretically target. We define hospitalization using a binary indicator at the resident-quarter level, coded as one if a MedPAR claim includes a relevant admission date during the quarter.

Figure 2 presents trends in hospitalization rates over time by I-SNP enrollment status. These trends reveal seasonal fluctuations and noticeable spikes during the COVID-19 pandemic. Hospitalization rates are consistently lower among I-SNP enrollees than non-enrollees, with the lowest rates observed among those enrolled in the UnitedHealthcare (UHC) I-SNP. Additionally, a comparison across the two panels in Figure 2 indicates that residents entering nursing homes under TM have higher hospitalization rates than those entering under MA.

Although MedPAR is commonly used to identify hospitalizations among MA enrollees, some concerns remain regarding the completeness of MedPAR data for this population (Cotterill 2023). To address this potential limitation, we also constructed a hospitalization measure based on discharge assessments from the MDS. Prior research (Rahman, Tyler, et al. 2014) has shown that MDS discharge assessments are reasonably complete and provide a reliable alternative source for identifying hospital transfers. We also examine several nursing home quality-of-care indicators derived from MDS data to explore potential mechanisms for hospitalization reductions or unintended externalities. These include influenza vaccine uptake, the presence of pressure ulcers, the prescription of antipsychotic medications, self-reported pain, and ADL decline, among others.[3]

3.5 Control variables

We controlled for sociodemographic measures from the MBSF (i.e., age, sex, race/ethnicity, Medicaid enrollment) and health status measures derived from the MDS. These include the Morris activities of daily living (ADL) dependence scale and the Cognitive Function Scale (Thomas et al. 2017). We also included the MDS Changes in Health, End-stage disease and Symptoms and Signs (CHESS) score, which aggregates diagnostic, functional, symptom, and

[3] Pneumonia is a major cause of hospitalization among nursing home residents and a complication of influenza. Changes to wound care may reduce or increase the prevalence of pressure injuries and affect infection-related hospitalizations. Exposure to different primary care providers and practice patterns across payers may lead to differential antipsychotic use and impact hospitalization risk.

behavioral factors to predict mortality risk (Ogarek et al. 2018). Because health status can be affected by I-SNP *enrollment* and hospitalization, we included these measures as time-invariant for an individual and are based on MDS assessments before the individual became a long-stay resident.

4. Empirical Strategy

4.1 ***Empirical model***

We begin with the following specification to estimate the relationship between health outcomes and I-SNP enrollment, estimated via OLS:

$$Y_{ifqt} = \beta_1 ISNP_{it} + R_i\gamma + \sigma_q + \delta_t + \theta_f + \epsilon_{ifqt} \quad (1)$$

Where Y_{iqft} a health outcome for resident *i* of facility *f* during calendar year-quarter *t. q* represents the person-quarter since the index quarter of becoming a long-stay resident. $ISNP_{it}$ is a binary indicator for I-SNP enrollment for individual *i* during time *t.* R_i is a vector of individual-level health status controls, shown in Table 1. σ_q represent are quarter of residence fixed effects, which capture the average trajectory of outcomes during course of a nursing home stay. δ_t are calendar year-quarter fixed effects capturing the overall trend in outcomes. We include a facility fixed effect, θ_f, to capture any time-invariant effect of the nursing home or the market on outcomes. The heteroskedasticity-robust error term is clustered at the facility level.

4.2 ***Inference problem: patient selection***

The estimate of interest in equation (1), β_1, is likely to be biased due to supply- and demand-side factors. On the demand side, several unobserved resident-level factors that are correlated with socioeconomic or unobserved health status, and ergo hospitalization risk, may drive I-SNP enrollment. For example, residents with involved caregivers may more easily solicit I-SNP representatives (a nurse practitioner if the model is UHC-NHP). Alternatively, individuals with complex care needs may selectively enroll into I-SNPs to take advantage of more the more intensive care coordination and management offered. On the supply side, due to capitated financing I-SNPs may target for enrollment residents with low unobserved hospitalization risk, or families with already-strong preferences for less intensive care. At the organizational level, I-SNPs may selectively contract with nursing homes based on resident mix, staffing patterns, or other structural characteristics. While facility fixed effects control for time-invariant organizational factors, their inclusion may amplify resident-level selection bias.

Although the direction of the selection bias is not completely clear, it is plausible that healthier residents are more likely to join I-SNP and that the estimate of β_1 from (1) will be biased downward. Some of the descriptive comparisons support this concern; as shown in Appendix Table 2, I-SNP enrollees became long-stay residents at younger ages, had longer observation windows, and had lower mortality risk at admission. I-SNP enrollees were also more likely to be from racial/ethnic minorities and dually enrolled in Medicaid. Residents not enrolled in I-SNPs appear comparable across nursing homes regardless of whether the facility offers an I-SNP, and these patterns are consistent for both MA and TM entry cohorts. Because these observable differences suggest the potential for bias due to unobserved confounders, our primary inferential challenge is to address the endogeneity of I-SNP enrollment in estimating its causal effect on outcomes.

4.3 Nursing home's adoption of I-SNP as the instrumental variable

MA organizations must collaborate with nursing homes to offer I-SNPs, and a resident can enroll in an I-SNP only after their nursing home begins contracting with one. As we described earlier, the number of I-SNP plans and levels of enrollment have grown over time. In Figure 3, we show that a sizable share of nursing homes has contracted with an I-SNP (close to one in four facilities in 2022). We defined a nursing home as participating in a particular I-SNP type (UHC or not) if the nursing home had at least two unique residents enrolled in that type of plan for a total of 5-person months. The proportion of nursing homes participating in a UHC I-SNP increased from 5.8% in 2011 to 13.4% in 2022. Most of the growth in non-UHC I-SNP participation occurred during our study period (2016 to 2022), rising from a prevalence of 1.8% of nursing homes participating to 11.1%. Our approach exploits this large temporal variation in nursing home I-SNP participation. We argue that given the nursing home fixed effects, once the nursing home starts offering an I-SNP, there is an uptake of I-SNP enrollment among its residents (first stage relationship).

Specifically, we instrument for residents' I-SNP enrollment with nursing home's I-SNP participation using the following equations, estimated via two-stage least squares:

$$ISNP_{ifq} = PART_{ft} + R_i\alpha + \sigma_q + \delta_t + \theta_f + \mu_{iqft} \qquad (2)$$

$$Y_{ifqt} = \beta_1\widehat{ISNP}_{ifq} + R_i\gamma + \sigma_q + \delta_t + \theta_f + \epsilon_{iqft} \qquad (3)$$

Equation (2) is the first stage that estimates the probability of I-SNP enrollment as a function of the controls in equation (1) with the addition of $PART_{ft}$, a binary indicator of whether nursing home *f* is participating in an I-SNP at time *t.* Equation (3) is the second stage that estimates outcomes as a function of the instrument-dependent probability of I-SNP enrollment $\widehat{ISNP}_{ifq}$ predicted from equation (2). Because of the inclusion of nursing home fixed effects and calendar quarter fixed effects, it is effectively an IV analysis in a difference-in-difference setup.

Our identification strategy bears a close resemblance to a cluster randomized trial (CRT) in structure, though the assignment of treatment is not randomized. In this context, nursing homes serve as clusters, and I-SNP participation functions as the cluster-level "assignment" mechanism: residents may enroll in an I-SNP only if their nursing home contracts with one. This within facility variation in I-SNP participation over time allows us to estimate causal effects analogous to a local average treatment effect (LATE) in an encouragement design. The first stage of our IV strategy captures the increase in enrollment following facility-level adoption, while the second stage isolates the effect of I-SNP enrollment among compliers. With the inclusion of facility and calendar quarter fixed effects, and standard errors clustered at the facility level, our empirical setup mimics key elements of a CRT with staggered rollout (i.e., a stepped-wedge design), where treatment adoption occurs at different times across clusters.

4.4 ***Resident fixed effect model as an alternative solution***

Given the longitudinal nature of our data, we also estimate equation (1) with resident fixed effects, replacing nursing home fixed effects. Because residents rarely switch facilities, this approach absorbs time-invariant individual characteristics, addressing endogeneity from patient selection if unobserved health status remains constant over time. However, if residents who eventually enroll in an I-SNP follow systematically different health trajectories than those who do not, OLS estimation with resident fixed effects may still yield biased estimates of β_1. As such, we also estimate a 2SLS model using the same IV strategy to address this concern. In this specification, identification comes from within-resident variation in I-SNP availability across quarters of their stay, leveraging the timing of I-SNP adoption at the facility level.

4.5 ***Assessing the Exclusion Restriction: Pre-Trends Test***

A key identifying assumption in our IV strategy is that, conditional on controls and fixed effects, nursing home adoption of I-SNPs is not systematically related to underlying trends in outcomes. This exclusion restriction may be violated if nursing homes that adopt I-SNPs are already experiencing changes in quality of care prior to adoption. For instance, if adoption follows a period of declining quality, the estimated effect of I-SNPs would understate their true impact. Conversely, if adoption follows an improvement trend, the estimated effect could be overstated.

To assess this possibility, we test for differential pre-trends by estimating a version of the reduced-form model where we replace the post-adoption indicator ($PART_{ft}$) with a series of leads and lags relative to the year of I-SNP adoption. Specifically, we include indicators for four years prior to adoption (–4 to –1) and five years following adoption (+1 to +5), omitting the year before adoption as the reference category. We include the same covariates and fixed effects as in model (1). The coefficients on the pre-adoption indicators provide a direct test of the exclusion restriction: significant differences would suggest violation due to differential pre-trends in outcomes across adopting and non-adopting facilities.

4.6 *Assessing the Exclusion Restriction: Compositional Changes in the Long-Stay Resident Pool*

Another potential violation of the exclusion restriction arises if I-SNP participation influences health status through changes to the composition of residents entering long-stay care. If the availability of an I-SNP makes a nursing home more attractive to certain types of residents—for example, those who are healthier or have a greater care-coordination needs—our IV estimates may be biased. This concern is particularly relevant for specifications with nursing home fixed effects, where identification comes from within-facility variation over time.

To assess this, we examined how observed health status and demographics of those who newly became long-stay residents during the study years are associated with facility I-SNP participation. Thus, we restrict the sample to each individual's first observed quarter as a long-stay resident and estimate models where individual characteristics at the index date are regressed on an indicator for whether the nursing home offers an I-SNP during that calendar year. All models include nursing home and calendar quarter fixed effects. In addition to observable characteristics, we examine whether I-SNP participation is associated with longer follow-up (i.e., number of observed quarters) and one- and two-year survival following the index date, as indirect indicators of underlying health status the time of nursing home entry.

4.7 *Assessing the Exclusion Restriction: Spillover Effects on Non-Enrollees*

A potential threat to the exclusion restriction in our IV design is the presence of spillover effects. If I-SNP adoption leads to facility-wide changes, such as improved staffing, care coordination, or clinical practices, then non-enrolled residents may also experience reductions in

hospitalization. In this case, the instrument affects outcomes not solely through enrollment, violating the exclusion restriction. Because the first stage captures only changes in enrollment while the reduced form reflects average outcome changes across all residents, the IV estimate may overstate the effect of I-SNP enrollment—that is, it may be biased away from zero.
To test the external effect of I-SNP presence in nursing home on its residents who are not I-SNP enrollee, we estimate the following equation with OLS:

$$Y_{ifqt} = \beta_0 PART_{ft} + \beta_1 ISNP_{ift} * PART_{ft} + R_{iq}\gamma + \sigma_q + \delta_t + \theta_i + \epsilon_{iqft} \quad (4)$$

This equation estimates how the likelihood of hospitalization for non-enrollees (β_0) and enrollees (β_1) differ from the residents in corresponding nursing homes before I-SNP participation after controlling for the industry wide trends. Here, we assume that the individual fixed effects (θ_i) fixes the endogeneity due to selective I-SNP enrollment. If $\beta_0 = 0$, our estimated β_1 from IV estimation is not impacted by spillover effects should be statistically the same as β_1 in equation (4). We also estimated an alternative version of equation (4) distinguishing UHC and non-UHC I-SNP participation of nursing homes and enrollment of residents.

Recognizing that spillovers might vary with the duration or maturity of the collaboration between the plan and the nursing home, we further estimated a staggered version of Equation (4), which effectively functions as a difference-in-differences model with heterogeneous treatment effects. In this specification, outcomes are regressed on a series of indicators for time relative to I-SNP adoption (four pre-adoption years and five post-adoption years, with the year immediately preceding adoption as the reference), as well as interactions between individual I-SNP enrollment and the post-adoption indicators. Here, the coefficients on the post-adoption indicators directly test for spillover effects on non-enrollees, while the interaction terms capture the evolution of the treatment effect (or maturity effects) on I-SNP enrollees.

5. Results

5.1 **First Stage: Effect of Nursing Home I-SNP Participation on Individual Enrollment**

Table 2 lists the first-stage estimates of the effect of nursing home I-SNP participation on an individual's likelihood of enrolling in an I-SNP. We present results separately for residents who entered the nursing home as MA and TM enrollees, and for specifications with nursing home fixed effects and individual fixed effects. Across all models, nursing home I-SNP participation is strongly associated with increased I-SNP enrollment. Among MA entrants, nursing home' I-SNP participation increases the likelihood of individual enrollment by 23.6

percentage points in the nursing home fixed effects model and by 19.5 percentage points in the individual fixed effects model. Among TM entrants, the estimated effects are slightly smaller but still substantial, at 20.7 and 19.1 percentage points, respectively.

All coefficients are statistically significant at the 1% level, with large t-statistics. The F-statistics are exceedingly high—far exceeding the conventional threshold of 10 that is commonly used to indicate strong instruments in the IV literature (Staiger and Stock 1997). Such high values provide robust evidence that our instrument is highly relevant and alleviates concerns about weak instrument bias in our analysis. The models with individual fixed effects explain more variation in enrollment ($R^2 = 0.792$ for MA and 0.734 for TM), reflecting the inclusion of person-level heterogeneity. These results confirm that I-SNP availability at the facility level is a strong predictor of individual enrollment, supporting the instrument relevance assumption. We also illustrate the first-stage graphically in Appendix Figure 2, which displays rates of I-SNP enrollment before and after an I-SNP becomes available in a facility.

Appendix Table 3 presents first-stage estimates that differentiate between the effects of nursing homes offering UHC I-SNPs versus non-UHC I-SNPs on resident enrollment in the corresponding plan types. For MA entrants, nursing homes offering a UHC I-SNP increase UHC I-SNP enrollment by 24 percentage points in the nursing home fixed effects specification (0.246, $t = 41.59$) and 20.5 percentage points in the individual fixed effects model (0.205, $t = 34.19$). In contrast, the same facilities show a modest negative association with non-UHC I-SNP enrollment (−0.0239 to −0.0306). Conversely, facilities offering non-UHC I-SNPs are associated with a 23–23.2 percentage point increase in non-UHC I-SNP enrollment ($t \approx 31$–39) and a slight negative cross-effect on UHC I-SNP enrollment. Similar patterns emerge for TM entrants, with UHC offerings increasing UHC I-SNP enrollment by approximately 20 percentage points and non-UHC offerings boosting non-UHC I-SNP enrollment by around 22 percentage points.

An important part of our analyses is the difference in competing risk of enrollment into different plans between MA and TM entrants. Prior studies document increases in MA plan disenrollment after nursing home use (Rahman, Keohane, et al. 2015; Goldberg et al. 2017). As such, we also examined how the likelihood of enrollment in TM and non-I-SNP MA plans change when nursing homes start offering I-SNPs. In Appendix Table 4, we examine the competing risks of enrollment when I-SNPs are offered, highlighting differential switching patterns between residents who entered as MA and those who entered as TM. The results confirm that the availability of I-SNPs significantly increases the likelihood of enrollment in I-SNPs across both groups. However, while TM entrants tend to remain in TM and switch to I-SNP only when offered, a substantial share of MA entrants switch to TM in the absence of I-SNP availability. Consequently, when I-SNPs are offered, we observe a marked reduction in the likelihood of enrollment in both TM and non-I-SNP MA plans among MA entrants. These patterns underscore the strong competitive incentive for nursing homes to offer I-SNPs, as doing so not only boosts I-SNP enrollment but also reshapes the overall enrollment mix by drawing MA entrants away from alternative plan types.

5.2 **Effect of individual's I-SNP enrollment on likelihood of hospitalization**

Table 3 shows the point estimates of the effect of I-SNP enrollment on the likelihood of hospitalization in a given quarter. For residents who entered as MA, the 2SLS estimates indicate that enrollment in any I-SNP is associated with a reduction in hospitalization probability of about 2.9 to 3.0 percentage points, whether using nursing home or individual fixed effects. When distinguishing by plan type, 2SLS results show that UHC I-SNP reduces the probability of hospitalization by 3.5 to 4.1 percentage points, whereas non-UHC I-SNP enrollment yields a smaller effect of around 2.0 to 2.2 percentage points. Among TM entrants, the 2SLS estimates show that I-SNP enrollment confers a roughly 4.3 percentage point reduction in the probability of hospitalization. When disaggregated, UHC I-SNP enrollment is associated with a slightly larger reduction (around 4.5 percentage points) in hospitalization compared to non-UHC I-SNP enrollment (approximately 3.0 to 3.6 percentage points).

When compared to the OLS estimates, the 2SLS coefficients are directionally consistent but smaller in magnitude, as OLS results indicate reductions in hospitalizations of approximately 3.1 to 3.9 percentage points for MA entrants who enrolled I-SNP and 3.7 to 4.3 percentage points for TM entrants who enrolled in I-SNPs. The effect of enrollment in UHC I-SNP is substantially larger than the effect of enrollment in non-UHC I-SNP among both MA and TM entrants. Overall, these results support the conclusion that I-SNP enrollment effectively reduces hospitalization risks among nursing home residents. We do not find consistent evidence that I-SNP enrollment conferred risk of any adverse secondary outcomes (Table 4). Importantly, using an MDS-based hospitalization measure yields estimates comparable to those from MedPAR data: I-SNP enrollment reduces the probability of discharge to any inpatient facility by roughly

2.92 percentage and 4.27 percentage points for residents originally enrolled in conventional MA plans and TM, respectively.

5.3 ***Assessment of exclusionary restrictions***

Figure 4 illustrates the evolution of hospitalization rates around the onset of I-SNP participation, using an event-study specification with the year before I-SNP participation as the reference category. The estimates reveal that hospitalization rates remain relatively stable in the pre-adoption period, with no significant trends observed prior to I-SNP initiation. Post-adoption, the coefficients indicate a statistically significant decline in hospitalizations, suggesting that the observed improvements in outcomes are likely driven by I-SNP participation. This lack of differential pre-trends supports the exclusion restriction by implying that any changes in hospitalizations can be attributed to the initiation of I-SNPs rather than to underlying trends.

Table 5 presents the changes in long-stay residents' characteristics following a nursing home's adoption of I-SNPs. Here we examined individuals who became long-stay resident during observation years 2016-2022 and assess whether the characteristics of individuals at entry and during their long-stay follow-up period changed after a facility began offering I-SNPs by regressing these outcomes on an indicator for I-SNP participation, controlling for nursing home and year-quarter fixed effects using beneficiary-level data. Overall, we observe no statistically significant association between I-SNP adoption and resident demographics, health status measures (including age, race, CHESS, CFS, and ADL), or follow-up outcomes such as 1-year and 2-year mortality, number of follow-up quarters, and nursing home switching. The sole exception is dual eligibility, which shows a statistically significant relationship with I-SNP participation. We also observed same patterns when we distinguish between UHC and non-UHC I-SNP participation of nursing homes (Appendix Table 6). The lack of significant differences in resident characteristics correlates with why models estimated with and without individual fixed effects yield similar estimates.

To examine the potential spillover effects, we first examined the trends in hospitalization rates among non-enrollees, separately by nursing home's I-SNP participation status and enrollees (Appendix Figure 1). Hospitalization rates for non-I-SNP enrollees were similar regardless of whether they are residing in an I-SNP participating nursing homes and were higher than I-SNP enrollees. Table 6 presents the estimation results from Equation (4) testing for spillover effects on hospitalization outcomes. In the specification that does not distinguish between I-SNP types, the coefficient on nursing home I-SNP participation is statistically insignificant for both MA and TM entrants, suggesting that mere facility participation does not affect hospitalization risk among non-enrollees. In contrast, the interaction between nursing home participation and resident I-SNP enrollment is highly significant and negative—reducing hospitalization likelihood by approximately 3.27 and 3.74 percentage points for residents originally enrolled conventional MA plans and TM, respectively. These are effectively the estimates reported in Table 3 from the OLS models with individual fixed effects. When distinguishing between UHC and non-UHC I-SNPs, neither NH's UHC nor non-UHC participation alone significantly affects outcomes, further supporting the absence of spillovers for non-enrollees.

Figure 5 presents the estimates from staggered version of equation (5) showing excess hospitalization among enrollees and non-enrollees in the years following nursing home adoption of I-SNPs. The graph displays event-time coefficients, with the year immediately preceding adoption as the reference period. The effects among non-enrollees were small and mostly statistically insignificant. However, coefficient for non-enrollees who entered as MA for years four and five following I-SNP adoption were statistically significant suggesting there can be a substantial spillover effects when the collaboration matures enough. Notably, the magnitude of the coefficients for I-SNP enrollees appears to increase in subsequent years, indicating an increasing effectiveness of I-SNP enrollment with maturity of the collaboration.

6. Conclusion

Enrollment of long-stay nursing home residents with dementia into specialized managed care plans (I-SNPs) reduces quarterly hospitalization rates, which have been close to 12% historically, by about a third. Combining these metrics with the 2 million person-quarters per year accounted for by the study population, about 80,000 hospitalizations out of 240,000 could have been avoided by I-SNP enrollment. This translates to 1.2 billion dollars in savings assuming the $15,000 average hospitalization cost for Traditional Medicare reported in 2021.[4] Results indicate that I-SNP enrollment reduces hospitalization rates by a large degree not only for individuals who switched from conventional MA plans into I-SNPs, but also Traditional Medicare beneficiaries who enrolled in I-SNPs. Furthermore, our results suggest that the reductions on hospitalizations grow larger over time, consistent with beneficial returns to scale

[4] Spending metrics available at: https://data.cms.gov/summary-statistics-on-use-and-payments/medicare-medicaid-service-type-reports/cms-program-statistics-medicare-inpatient-hospital

and/or improved effectiveness as the partnership between the nursing home and I-SNP matures. Our findings build upon earlier work that found I-SNPs are associated with fewer hospitalizations and emergency department visits. Notably, we find that the reductions in hospital use persist after accounting for patient selection in I-SNPs using an instrumental variable approach. Additionally, these findings align with several studies from non-nursing home settings showing that risk sharing and managed care models reduce the use of hospital care. Further work, however, is needed to test the mechanisms through which I-SNPs can achieve reduced hospital use. New data sources, such as electronic health records or MA encounter data, are critical for understanding what additional on-site services are needed to reduce nursing home-to-hospital transfers.

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Tables and Figures

Table 1: Descriptive Statistics

Variable	Enrolled in Medicare Advantage at nursing admission	Enrolled in Traditional Medicare at nursing admission
# of unique individuals	506,931	1,177,401
# of long-stay quarters observed	3,581,713	8,713,893
# of observed quarters, mean (SD)	7.07 (6.05)	7.40 (6.36)
Female, %	66.77%	66.48%
White, %	77.13%	79.69%
Black, %	13.25%	11.25%
Hispanic, %	7.07%	5.76%
Race other, %	2.55%	3.30%
Characteristics during the first quarter		
Age, mean (SD)	83.06 (7.97)	83.56 (8.22)
Dual eligibility, %	69.7%	65.4%
Cognitive functioning scale, mean (SD)	2.49 (0.87)	2.47 (0.88)
Activities of daily living score, mean (SD)	16.45 (5.78)	16.35 (6.01)
CHESS mortality risk score, mean (SD)	0.62 (0.84)	0.63 (0.85)
Mortality risk score 3.0, mean (SD)	5.25 (2.37)	5.33 (2.45)

Note: CHESS: The Changes in Health, End- stage Disease and Symptoms and Signs

Figure 1: Trends in institutional special needs plan (I-SNP) enrollment among long-stay nursing home residents

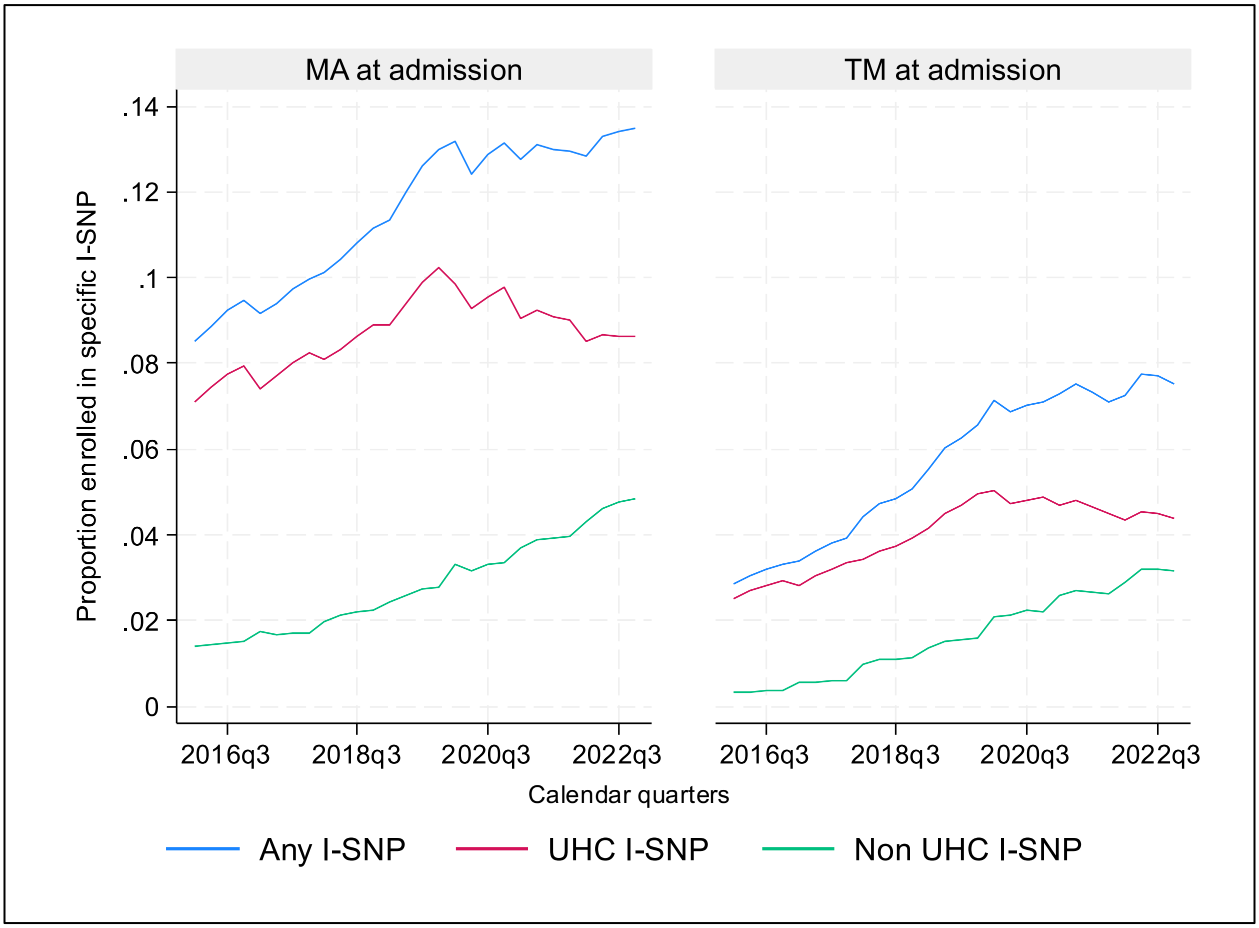


Figure 2: Trends in hospitalizations among long-stay nursing home residents with dementia with and without institutional special needs plan (I-SNP) enrollment

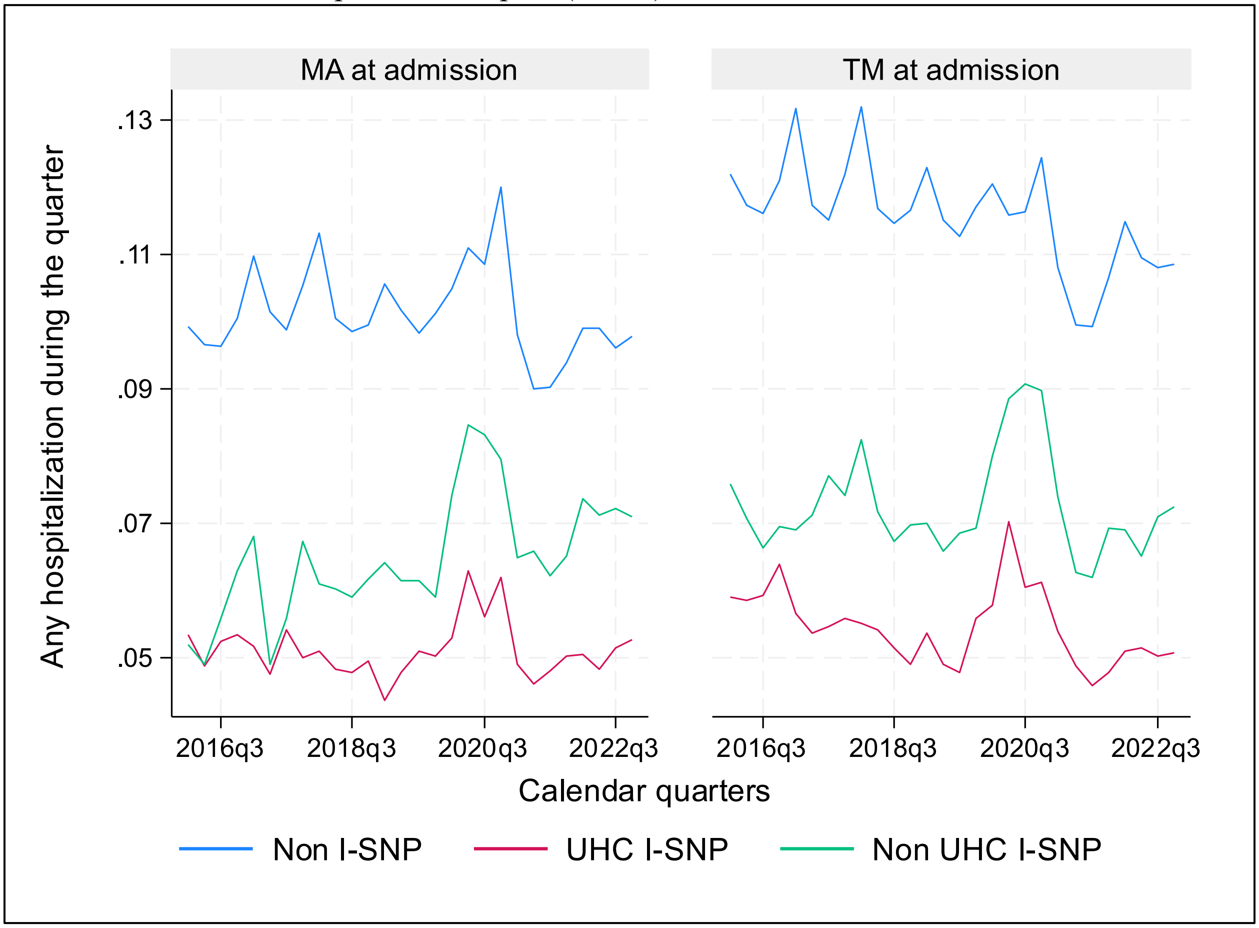


Figure 3: Trends in the share of nursing homes participating in an institutional special needs plan (I-SNP)

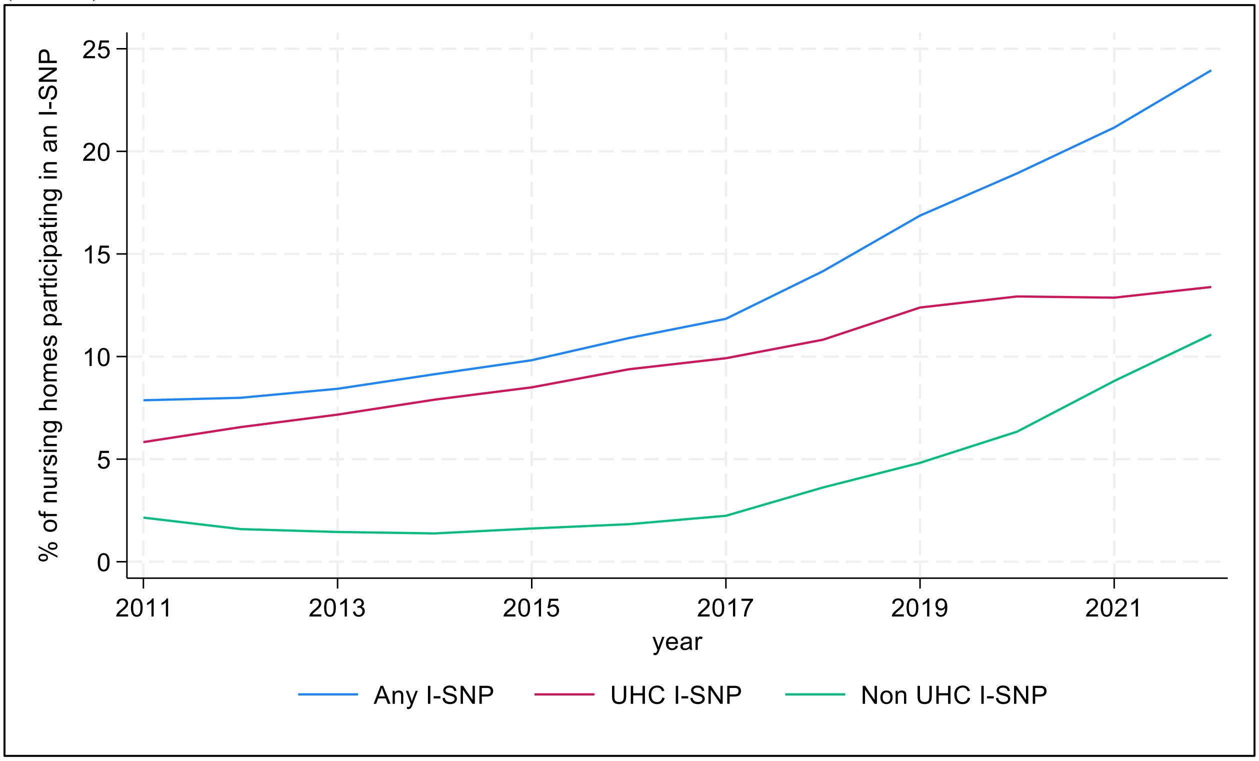


Table 2: First stage: the relationship between nursing home's institutional special needs plan (I-SNP) participation (instrumental variable) and residents' likelihood of enrolling in an I-SNP (treatment)

	MA at admission (N=3,581,713)		TM at admission (N=8,713,893)	
	Nursing home fixed effects	Individual fixed effects	Nursing home fixed effects	Individual fixed effects
Nursing home's participation in any I-SNP	0.236***	0.195***	0.207***	0.191***
	[56.49]	[45.83]	[64.42]	[55.47]
R-squared	0.371	0.792	0.285	0.734
F-statistic	3204.56	2100.6	4157.79	3077.3

Note: MA = Medicare Advantage; TM = traditional Medicare. All models include age, age squared, calendar year-quarter fixed effects, and individual follow-up quarter fixed effects. Nursing home fixed effects models also include individual characteristics at the first quarter of follow-up. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Estimated effects of institutional special needs plan (I-SNP) enrollment on likelihood of hospitalization in given quarter

Sample	Treatment variable specification	Explanatory variable	OLS		2SLS	
			Nursing home FE	Individual FE	Nursing home FE	Individual FE
MA at admission (N=3,581,713)	Without distinguishing between I-SNPs	Enrollment in any I-SNP	-0.0386***	-0.0317***	-0.0292***	-0.0301***
			[-48.96]	[-28.20]	[-7.066]	[-6.493]
	Distinguishing between enrollment in UHC and non-UHC I-SNP	Enrollment in UHC I-SNP	-0.0412***	-0.0352***	-0.035***	-0.0413***
			[-46.32]	[-28.28]	[-7.51]	[-7.636]
		Enrollment in non-UHC I-SNP	-0.0317***	-0.0234***	-0.022***	-0.0202***
			[-22.78]	[-11.34]	[-3.76]	[-3.325]
TM at admission (N=8,713,893)	Without distinguishing between I-SNPs	Enrollment in any I-SNP	-0.0404***	-0.0370***	-0.0432***	-0.0406***
			[-52.95]	[-37.49]	[-11.67]	[-12.78]
	Distinguishing between enrollment in UHC and non-UHC I-SNP	Enrollment in UHC I-SNP	-0.0428***	-0.0399***	-0.0449***	-0.0468***
			[-48.67]	[-34.23]	[-9.678]	[-11.34]
		Enrollment in non-UHC I-SNP	-0.0347***	-0.0313***	-0.0358***	-0.0294***
			[-25.39]	[-19.60]	[-7.107]	[-7.481]

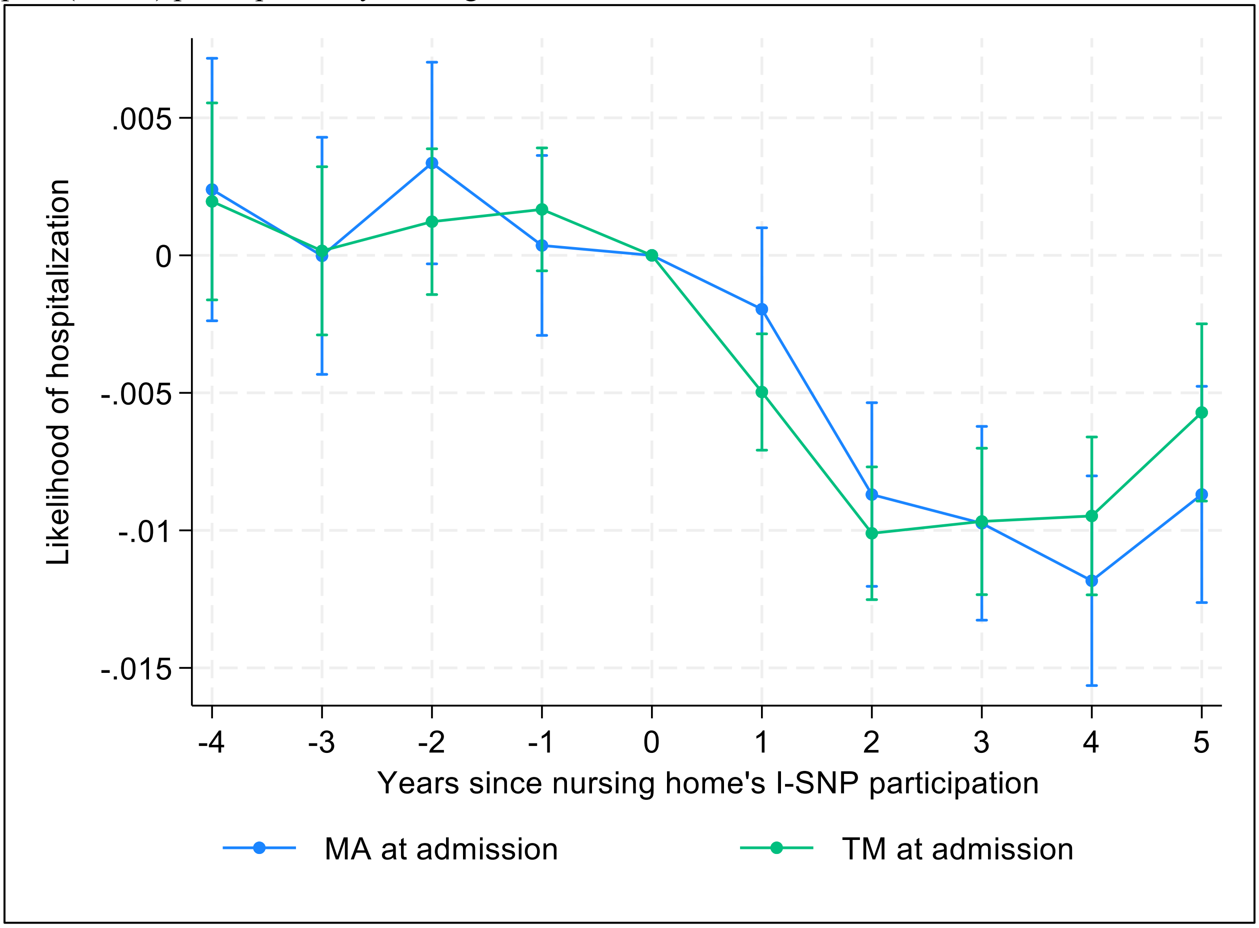
Note: All models include age, age squared, calendar year-quarter fixed effects, and individual follow-up quarter fixed effects. Nursing home fixed effects models also include individual characteristics at the first quarter of follow-up. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Estimated effects of institutional special needs plan (I-SNP) enrollment on secondary outcomes using nursing home fixed effect instrumental variable regression

Outcome	MA at admission N=3,581,645	TM at admission N=8,713,823
Any acute preventable admission	0.51%	0.78%
	-0.00213***	-0.00350***
	[-2.602]	[-4.428]
Received seasonal influenza vaccine	72.85%	74.29%
	0.0295***	0.0145
	[3.134]	[1.604]
One or more pressure ulcers	4.90%	5.40%
	-0.00359	-0.00733**
	[-1.066]	[-2.505]
Self-reported moderate to severe pain	3.05%	3.34%
	0.000302	-4.21E-05
	[0.102]	[-0.0155]
Physically restrained	0.28%	0.37%
	0.00269**	0.00219**
	[2.257]	[1.988]
Need for help with ADL has increased	13.04%	12.78%
	-0.00205	-0.00442
	[-0.410]	[-0.950]
Ability to move independently worsened	13.80%	13.56%
	-0.0187***	-0.0195***
	[-3.494]	[-3.999]
Received antipsychotic medication	15.71%	16.03%
	-0.000822	-0.0128*
	[-0.0980]	[-1.713]
MDS discharge status: any inpatient facility	8.54%	10.27%
	-0.0292***	-0.0427***
	[-7.571]	[-12.24]

Note: All models include age, age squared, individual characteristics at the first quarter of follow-up, calendar year-quarter fixed effects, individual follow-up quarter fixed effects and nursing home fixed effects. For each outcome, first row provides the average of the outcome variable in corresponding sample. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Figure 4: Changes in hospitalizations before and after the initiation of institutional special needs plan (I-SNP) participation by nursing home



Note: The first year of I-SNP participation is coded as 1. The fifth year and higher following I-SNP participation is coded as 5. The fourth and prior years before I-SNP participation were coded as -4. Nursing homes that did not participate in an I-SNP were coded as zero. The estimates are based on the regression of outcome onto indicators of years since I-SNP participation, with year 0 as the benchmark category. Control variables include age, beneficiary characteristics at admission and nursing home, calendar quarter, individual follow-up quarter fixed effects.

Table 5: Changes in Long-Stay Resident Characteristics and Lenth of Follow-up Following Nursing Home institutional special needs plan (I-SNP) Adoption

		MA at admission N=389,535	TM at admission N=763,195
Characteristics of the individuals at the start of their long-stay residence	Age	0.00878	0.0776
		[0.142]	[1.531]
		(82.61)	(83.09)
	Race: White	-0.00211	0.000245
		[-0.73]	[0.11]
		(0.832)	(0.816)
	Dual eligible	0.0086**	-0.0171***
		[2.42]	[-5.85]
		(0.574)	(0.545)
	CHESS	0.00403	0.00111
		[0.561]	[0.175]
		(0.649)	(0.672)
	CFS	0.00279	-0.00392
		[0.403]	[-0.696]
		(2.493)	(2.489)
	ADL	-0.0102	-0.0117
		[-0.213]	[-0.312]
		(16.49)	(16.50)
Summary measures based on follow up quarters	Share of follow-quarters with I-SNP enrollment	0.104***	0.0263***
		[25.64]	[12.47]
		(0.076)	(0.028)
	1-year mortality	0.000885	0.000519
		[0.243]	[0.176]
		(0.351)	(0.355)
	2-year mortality	-0.0022	0.000472
		[-0.578]	[0.157]
		(0.516)	(0.528)
	Number of quarters followed	0.0349	0.0502
		[0.858]	[1.471]
		(6.492)	(6.875)
	Any switching of nursing homes	-0.00275	-0.00122
		[-1.147]	[-0.701]
		(0.093)	(0.083)

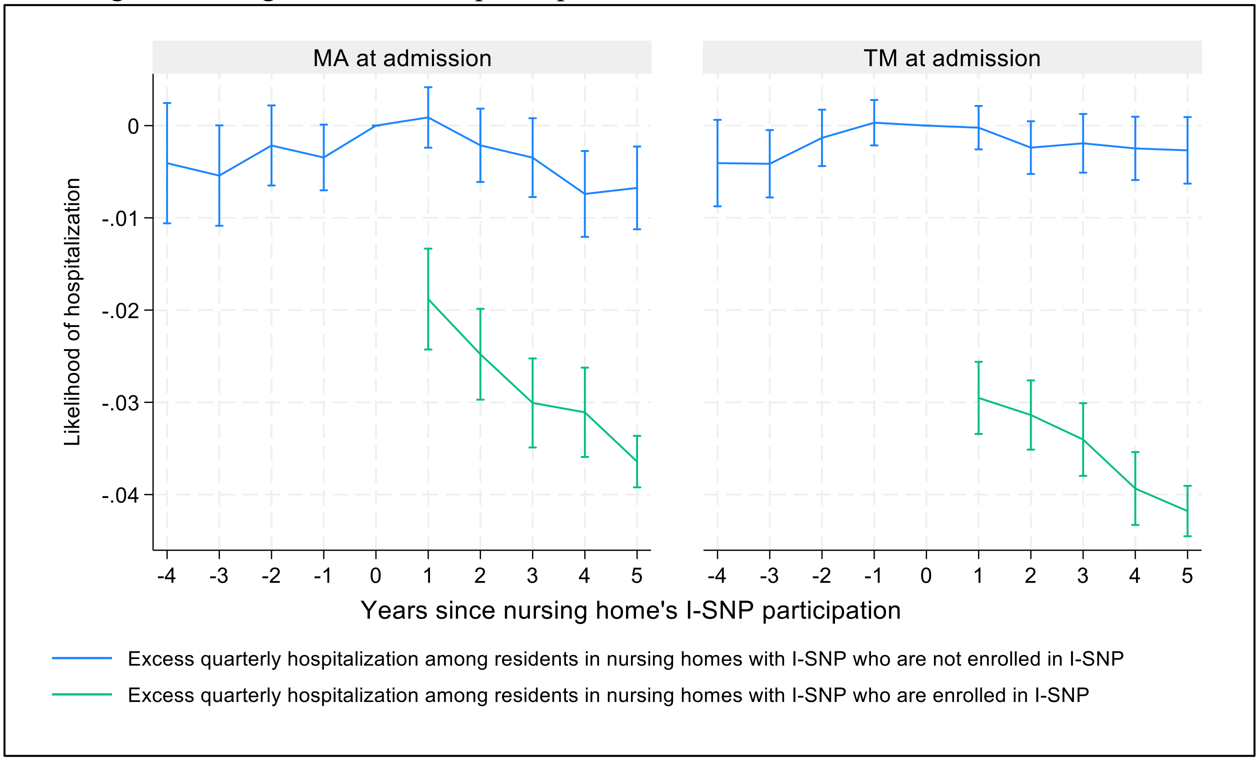
Note: All models calendar year-quarter (of the first follow up quarter) fixed effects and nursing home fixed effects. The average of the outcome variable in corresponding sample are reported in parentheses. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression results related to testing of spillover effects

	MA at admission N=3,581,713		TM at admission N=8,713,893	
Explanatory variable	Without distinguishing between I-SNPs	Distinguishing between UHC and non-UHC I-SNPs	Without distinguishing between I-SNPs	Distinguishing between UHC and non-UHC I-SNPs
NH's I-SNP participation	0.00123		-0.00055	
	[1.021]		[-0.609]	
NH's I-SNP participation x resident's I-SNP enrollment	-0.0327***		-0.0374***	
	[-28.38]		[-36.29]	
NH's UHC I-SNP participation		-0.000281		-0.00127
		[-0.208]		[-1.187]
NH's non-UHC I-SNP participation		0.00166		0.00101
		[0.963]		[0.788]
NH's UHC I-SNP participation x resident's UHC I-SNP enrollment		-0.0358***		-0.0401***
		[-27.79]		[-32.92]
NH's UHC I-SNP participation x resident's UHC I-SNP enrollment		-0.0254***		-0.0330***
		[-11.88]		[-19.07]

Note: All models include age, age squared, calendar year-quarter fixed effects, individual follow-up quarter fixed effects, and individual fixed effects. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Figure 5: Effect of institutional special needs plan (I-SNP) enrollment on hospitalization in years following the nursing home's I-SNP participation



Note: All models include age, age squared, calendar year-quarter fixed effects, individual follow-up quarter fixed effects, and individual fixed effects. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Is Managed Care Effective in Long-term Care Settings? Evidence from Medicare Institutional Special Needs Plans
Statistical Appendix
August 2025

Appendix Table 1: Distribution of observations by year

Year	MA at admission	TM at admission	All
2016	1,337,062	458,922	1,795,984
2017	1,369,972	486,055	1,856,027
2018	1,371,591	513,749	1,885,340
2019	1,360,465	545,553	1,906,018
2020	1,228,976	540,815	1,769,791
2021	1,027,043	497,043	1,524,086
2022	1,018,784	539,576	1,558,360
All	8,713,893	3,581,713	12,295,606

Appendix Table 2: Average characteristics of individuals in nursing homes that ever participated in an institutional special needs plan (I-SNP)

	Traditional Medicare at admission			Medicare Advantage at admission		
	Nursing homes without I-SNP	Nursing homes with I-SNP		Nursing homes without I-SNP	Nursing homes with I-SNP	
		Individuals did not join I-SNP	Individuals joined I-SNP		Individuals did not join I-SNP	Individuals joined I-SNP
# of unique individuals	774,661	335,457	67,283	282,812	163,906	60,213
# of observed quarters	7.39	6.54	11.83	7.02	6.09	9.91
Age	83.68	83.51	82.35	83.18	83.07	82.46
Female, %	66.3%	65.9%	71.5%	66.5%	65.9%	70.6%
White, %	82.4%	75.3%	70.9%	80.7%	73.2%	71.1%
Black, %	9.3%	14.3%	18.6%	10.5%	16.2%	18.3%
Hispanic, %	5.1%	7.0%	7.5%	6.3%	8.0%	8.3%
Race other, %	3.3%	3.5%	2.9%	2.5%	2.7%	2.3%
Dual eligibility, %	62.1%	66.6%	85.1%	67.3%	71.4%	86.5%
Cognitive functioning scale	2.46	2.50	2.39	2.49	2.52	2.44
Activities of daily living score	16.11	17.08	15.83	16.20	16.93	15.91
CHESS mortality risk score	0.63	0.68	0.49	0.62	0.67	0.52
Mortality risk score 3.0	5.34	5.41	4.82	5.26	5.33	4.96

Appendix Table 3: First stage with specific types of institutional special needs plan (I-SNPs): the relationship between nursing home's I-SNP participation in UHC and non-UHC I-SNPs (instrumental variable) and residents' likelihood of enrolling in an I-SNP (treatment)

	MA at admission (N=3,581,713)				TM at admission (N=8,713,893)			
	Enrollment in UHC I-SNP		Enrollment in non-UHC I-SNP		Enrollment in UHC I-SNP		Enrollment in non-UHC I-SNP	
	Nursing home FE	Individual FE	Nursing home FE	Individual FE	Nursing home FE	Individual FE	Nursing home FE	Individual FE
Nursing home's offering UHC I-SNP	0.246***	0.205***	-0.0239***	-0.0306***	0.200***	0.182***	-0.0131***	-0.0179***
	[41.59]	[34.19]	[-8.287]	[-6.848]	[51.47]	[44.60]	[-6.899]	[-7.110]
Nursing home's offering in non-UHC I-SNP	-0.0357***	-0.0517***	0.232***	0.219***	-0.0169***	-0.0276***	0.218***	0.220***
	[-7.635]	[-10.67]	[39.42]	[31.58]	[-8.507]	[-11.00]	[45.38]	[39.33]
R-squared	0.395	0.801	0.34	0.752	0.289	0.747	0.286	0.680
F-statistic	868.86		798.93		1358.39		1051.00	

Note: All models include age, age squared, calendar year-quarter fixed effects, and individual follow-up quarter fixed effects. Nursing home fixed effects models also include individual characteristics at the first quarter of follow-up. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: Alternative first stage and competing risk of enrollment in other plans: the relationship between residents' likelihood of enrolling in an institutional special needs plan (I-SNP) (treatment) and nursing home's UnitedHealthcare (UHC) and non-UHC I-SNP participation (instrumental variable) using nursing home fixed effect models

	MA at admission			TM at admission		
	Enrollment in any I-SNP	Enrollment in TM	Enrollment in non-I-SNP MA plan	Enrollment in any I-SNP	Enrollment in TM	Enrollment in non-I-SNP MA plan
NH's offering UHC I-SNP	0.225***	-0.0918***	-0.133***	0.186***	-0.181***	-0.00493***
	[40.95]	[-16.59]	[-27.23]	[47.64]	[-43.36]	[-3.961]
NH's offering in non-UHC I-SNP	0.198***	-0.0786***	-0.119***	0.200***	-0.193***	-0.00583***
	[25.58]	[-17.87]	[-19.69]	[39.96]	[-37.71]	[-4.165]
N	3,316,586	3,316,586	3,316,586	8,979,020	8,979,020	8,979,020
R-Squared	0.384	0.235	0.311	0.279	0.235	0.134

Note: All models include age, age squared, calendar year-quarter fixed effects, individual follow-up quarter fixed effects, and individual characteristics at the first quarter of follow-up. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5: Estimated effects of UnitedHealthcare (UHC) and Non-UHC institutional special needs plan (I-SNP) enrollment on secondary outcomes using nursing home fixed effect instrumental variable regression

	MA at admission N=3,316,586		TM at admission N=8,979,020	
	Effect of UHC I-SNP enrollment	Effect of non-UHC I-SNP enrollment	Effect of UHC I-SNP enrollment	Effect of non-UHC I-SNP enrollment
Any acute preventable admission	-0.00332***	0.000439	-0.00278***	-0.00431***
	[-3.603]	[0.398]	[-3.007]	[-4.008]
Received seasonal influenza vaccine	0.0352***	0.0147	0.0171	0
	[3.126]	[1.054]	[1.515]	[0.913]
One or more pressure ulcers	-0.00565	-0.00358	-0.00746**	0
	[-1.409]	[-0.709]	[-2.027]	[-0.485]
Self-reported moderate to severe pain	-0.00494	0.00729*	-0.00234	0
	[-1.355]	[1.742]	[-0.717]	[0.793]
Physically restrained	0.00278**	0.00579***	0.00106	0.00318**
	[2.023]	[4.223]	[0.697]	[2.346]
Need for help with ADL has increased	0.00738	-0.00449	-0.00575	0
	[1.169]	[-0.549]	[-0.919]	[-0.222]
Ability to move independently worsened	-0.00274	-0.0420***	-0.0114*	-0.0347***
	[-0.402]	[-5.372]	[-1.766]	[-5.367]
Received antipsychotic medication	-0.00128	-0.00167	-0.00521	-0.0194**
	[-0.125]	[-0.139]	[-0.546]	[-1.970]
MDS discharge status: any inpatient facility	-0.0347***	-0.0204***	-0.0453***	-0.0344***
	[-7.931]	[-3.725]	[-10.42]	[-7.267]

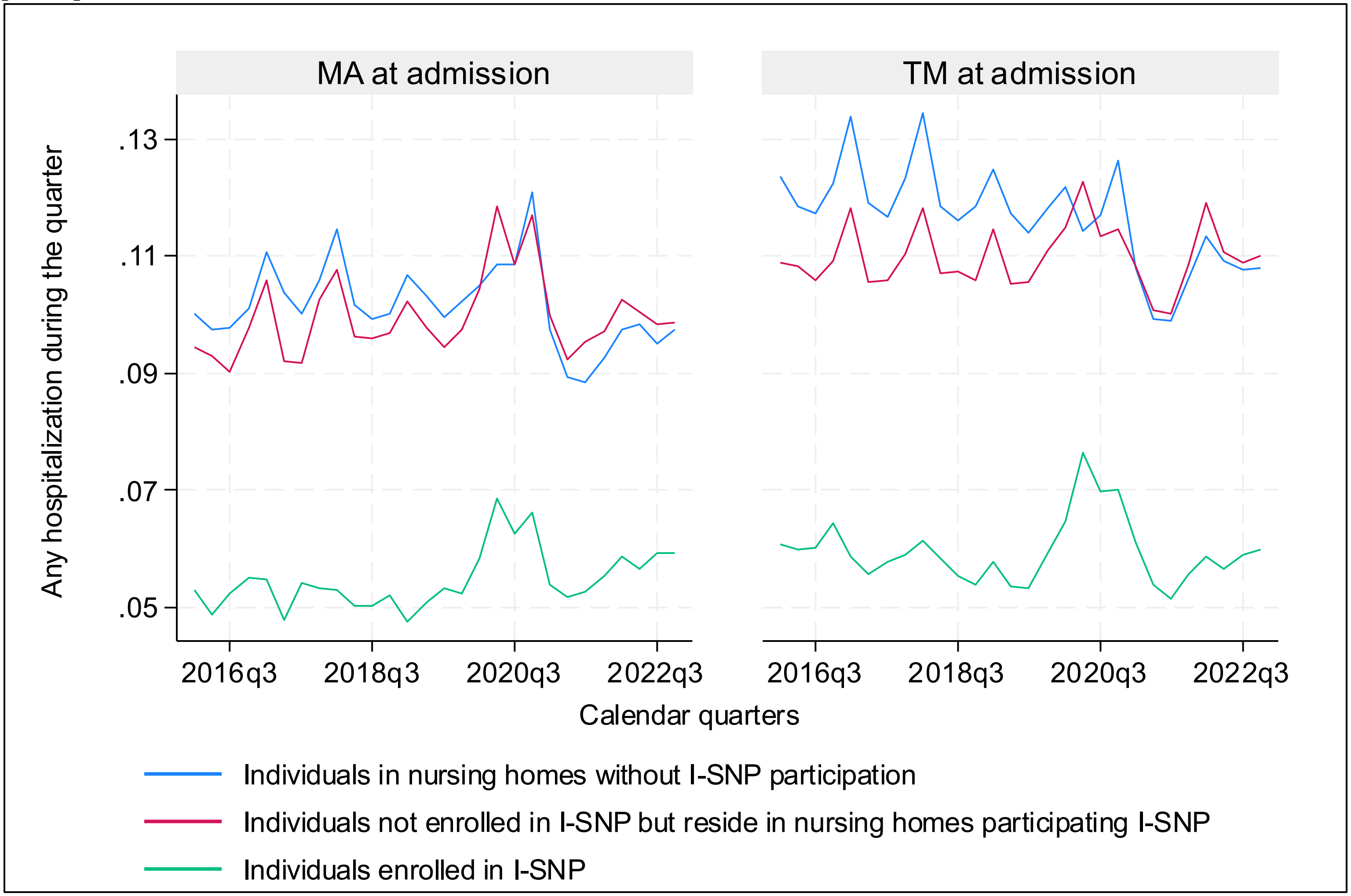
Note: All models include age, age squared, individual characteristics at the first quarter of follow-up, calendar year-quarter fixed effects, individual follow-up quarter fixed effects and nursing home fixed effects. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 6: Changes in Long-Stay Resident Characteristics and Lenth of Follow-up Following Nursing Home's UnitedHealthcare (UHC) and non-UHC institutional special needs plan (I-SNP) Adoption

		MA at admission N=389,535		TM at admission N=763,195	
		Coefficient	t-stat	Coefficient	t-stat
Age	NH's offering UHC I-SNP	0.0507	[0.693]	0.0834	[1.321]
	NH's offering non-UHC I-SNP	-0.0361	[-0.451]	0.0785	[1.118]
Race: White	NH's offering UHC I-SNP	-0.003	[-1.00]	-0.0008	[-0.32]
	NH's offering non-UHC I-SNP	0.003	[0.72]	0.0019	[0.58]
Dual eligible	NH's offering UHC I-SNP	0.0052	[1.19]	-0.013***	[-3.68]
	NH's offering non-UHC I-SNP	0.0076	[1.57]	-0.020***	[-5.14]
CHESS	NH's offering UHC I-SNP	0.00775	[0.929]	0.00629	[0.802]
	NH's offering non-UHC I-SNP	-0.00288	[-0.295]	-0.00684	[-0.784]
CFS	NH's offering UHC I-SNP	-0.00401	[-0.468]	-0.0128*	[-1.823]
	NH's offering non-UHC I-SNP	-0.00036	[-0.038]	0.0128	[1.619]
ADL	NH's offering UHC I-SNP	0.00505	[0.0921]	0.0507	[1.103]
	NH's offering non-UHC I-SNP	-0.0868	[-1.329]	-0.105*	[-1.882]
Share of follow-up quarters enrolled in I-SNP	NH's offering UHC I-SNP	0.0966***	[23.32]	0.0263***	[12.48]
	NH's offering non-UHC I-SNP	0.0788***	[16.71]	0.0270***	[11.16]
1-year mortality	NH's offering UHC I-SNP	-0.00023	[-0.052]	0.00229	[0.623]
	NH's offering non-UHC I-SNP	0.000215	[0.0453]	-0.0007	[-0.177]
2-year mortality	NH's offering UHC I-SNP	-0.0032	[-0.713]	0.000486	[0.130]
	NH's offering non-UHC I-SNP	-0.00273	[-0.546]	0.00133	[0.329]
Total number of follow up quarters	NH's offering UHC I-SNP	0.048	[0.949]	0.0239	[0.555]
	NH's offering non-UHC I-SNP	0.0107	[0.203]	0.0834*	[1.813]
Switched to another nursing home	NH's offering UHC I-SNP	0.00101	[0.350]	1.71E-05	[0.00789]
	NH's offering non-UHC I-SNP	-0.00561*	[-1.825]	-0.00421*	[-1.747]

Note: All models calendar year-quarter (of the first follow up quarter) fixed effects and nursing home fixed effects. The average of the outcome variable in corresponding sample are reported in parentheses. T-statistics reported in square brackets are obtained from clustering errors at the nursing home level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Figure 1: Trends in hospitalization among I-SNP and non-I-SNP enrollees in nursing homes with and without I-SNP participation



Appendix Figure 2: I-SNP Enrollment Rates After Adoption