Firm Finances and the Spread of COVID-19: Evidence from Nursing Homes*

Taylor A. Begley†
Daniel Weagley‡

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Abstract

We find that firms' financial resources play an important role in mitigating the spread of COVID-19. We study nursing homes – whose residents account for over one-third of all U.S. COVID-19 deaths – at a time when investment in risk mitigation was costly and critical. Facilities with less liquidity and those experiencing more severe cash flow shocks had a higher likelihood of COVID-19 reaching residents. These patterns are strongest for financially constrained facilities. We also find higher rates of transmission between staff and residents within liquidity-constrained facilities, which is consistent with these facilities creating a less-effective barrier between groups.

Keywords: stakeholder welfare, COVID-19, liquidity, financial constraints.
JEL Classification: G30, G32, I10

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†Olin Business School, Washington University in St. Louis; email: tbegley@wustl.edu.
‡Georgia Institute of Technology; email: daniel.weagley@scheller.gatech.edu.

1 Introduction

The COVID-19 pandemic has disrupted nearly all parts of society. Organizations including small private businesses, large public firms, the government at various levels, and school and university systems have faced extraordinary challenges when considering health risk mitigation measures. These challenges come during a time of severe financial strain. Further, these risk mitigation measures can have significant consequences for an organization's customers, employees, and the broader public. In this paper, we examine the role that a firm's financial health plays in its ability to slow the spread of COVID-19 and protect its nonfinancial stakeholders. Specifically, we examine detailed data on skilled nursing facilities ("nursing homes") to uncover an important relationship between firm finances and the spread of COVID-19. Our main tests use within-county variation to find that nursing homes with lower pre-pandemic cash-on-hand and nursing homes that experienced a more adverse cash flow shock during the pandemic are more likely to have residents that end up with COVID-19 and are more likely to have within-facility transmission across staff and residents.[1]

By the end of 2020, there were over 130,000 COVID-19 deaths in nursing homes and other long-term care facilities in the United States. Despite making up less than 1% of the overall population, nursing homes have accounted for over one-third of the U.S. death toll.[2] The age and pre-existing health conditions of nursing home residents, their proximity to one another, and their reliance on close-contact physical care make outbreaks in nursing home facilities particularly devastating. As of October 18, 2020, about 73% of nursing homes had at least one resident with COVID-19. Understanding whether financial factors help explain variation in these outcomes has important implications for the role and method of government support and has broader applications to many other settings, especially where switching costs for customers are high.

[1] While we focus our analysis on whether a nursing home has at least one resident with a case of COVID-19, we find similar relationships for: (1) whether a nursing home has at least one resident COVID-19 death, (2) the number of resident COVID-19 cases, and (3) the number of resident COVID-19-related deaths.

[2] https://www.nytimes.com/interactive/2020/us/coronavirus-nursing-homes.html

In the nursing homes industry, the COVID-19 pandemic has had a significant adverse impact on revenues and costs. The inflow of new residents (and the associated revenue) dropped significantly with the halting of elective surgical procedures in most states. At the same time, costs increased substantially due to sharply rising prices and the need for risk mitigation (e.g., additional personal protective equipment and high-frequency testing of residents and staff) and increased labor costs (e.g., additional overtime pay for employees). The worldwide demand shock for PPE led to increases in prices for some equipment by over 1,000%, and some nursing homes reported increasing expenditures on PPE by over 4,700% compared to normal times (Flynn, 2020b).

For nursing homes to undertake investments to minimize the spread of COVID-19, they need liquidity – either substantial cash on hand or swift access to external financing. However, the average nursing home has only about 24 days' worth of expenses available in cash and equivalents ("days-cash-on-hand"), a prominent liquidity measure in the industry. Quick access to external sources of capital was severely limited by the combination of broad market turmoil and because the shock of the pandemic itself diminished the creditworthiness of nursing homes. Further, nursing homes' demand for liquidity was heightened as PPE suppliers began requiring advanced payment rather than providing trade credit. To examine whether lower liquidity translates to a higher likelihood of COVID-19 at a nursing home, we regress an indicator of whether a nursing home had at least one case of COVID-19 on the logarithm of the number of days-cash-on-hand. These regressions control for a number of other important determinants of the baseline likelihood of having a COVID-19 case such as a nursing home's size (number of inpatient days), number of employees, and facility quality ratings. We find that dropping from the 75th to 25th percentile of days-cash-on-hand corresponds to a 2.3 percentage points higher likelihood of having a COVID-19 case.

We next examine whether nursing homes that experienced a greater negative cash flow shock from the pandemic were more likely to have a case of COVID-19. Because of the persistence in the drivers of cash flows for nursing homes, a negative cash flow shock translates

both to lower current and lower future liquidity. The cash flows for nursing homes dropped as the inflow of new residents sharply declined. The drops were economically large and varied according to nursing homes' business model. The negative shock to cash flows was particularly challenging because the industry was in a precarious financial position pre-pandemic. As of August 2020, 55% of facilities were operating at a loss, and 72% said they could not sustain operations another year at the current pace, despite about 96% of nursing homes receiving some measure of government funding (AHCA NCAL, 2020).

The ideal experiment would randomly assign cash flow shocks across nursing homes to examine their role in COVID-19 incidence in residents. Instead, we use nursing homes' pre-pandemic business model as an ex-ante measure of cash flow exposure to the COVID-19 shock. A key element of a nursing home's exposure is its patient mix. Based on the source of their payment, residents are one of three types: Medicare, Medicaid, or private pay. Medicare covers residents on entry, typically after an acute care hospital setting. Crucially for our setting, the flow of Medicare residents sharply dropped as elective procedures were banned or voluntarily stopped across the country near the outset of the pandemic. We confirm that nursing homes with a larger Medicare share (the share of each nursing home's inpatient days covered by Medicare) experienced larger declines in resident populations following the onset of the pandemic and elective procedure bans. Medicare residents are reimbursed at much higher rates than other residents, suggesting the percentage decrease in revenues is even larger than the percentage decrease in residents. Thus, nursing homes with a greater reliance on Medicare residents experience a larger negative shock to cash flows due to the stoppage of elective procedures. We find that a one-standard-deviation increase in Medicare share (about 10 percentage points) corresponds to a 3.2 percentage point higher likelihood of COVID-19 at the nursing home. Figure 1 presents binned scatter plots illustrating the strong relationships between COVID-19 likelihood and our main financial variables.

The richness of our data allows us to directly address many potential concerns that other factors may confound our variables of interest. We show that higher Medicare share

facilities have superior quality ratings and argue it is unlikely that nursing homes that are systematically better on observables are systematically worse on unobserved dimensions. We address concerns that Medicare share or cash-on-hand may be correlated with sub-county demographic factors related to COVID-19 spread by controlling for minority share and average income at the zipcode level. Another potential concern is that our financial variables are correlated with nursing home foot traffic and the volume of visits by outsiders and staff, which increases the probability of COVID-19 transmission. We directly control for the typical number of visitors or visits to each nursing home using mobility data from SafeGraph. We control for facility density using the building's square footage per resident. We find the inclusion of these control variables has only a minimal effect on the coefficients of interest. We also re-examine our tests while controlling for detailed differences in nursing homes' medical capabilities and typical patient mix and find similar results.

After establishing the robustness of our main cross-sectional tests, we examine within-facility outcomes. We use an approach similar to a "first-difference" regression, where the outcome variable is the difference between COVID-19 incidence among residents minus COVID-19 incidence in staff within the same nursing home. Since staff have been show to be a key source of exposure for residents (New York State Department of Health, 2020; Chen, Chevalier, and Long, 2020), we expect facilities that can invest more in PPE and other risk mitigation measures to have a relatively weak relationship between COVID-19 in residents and staff. We expect a strong link between resident and staff COVID-19 incidence for firms in a weaker financial position. This test's structure allows us to control for unobserved nursing-home-specific factors that similarly affect the incidence of COVID-19 across the staff and patients of a nursing home (e.g., visitation policies or culture of compliance). We indeed find a disproportionately tight relationship in the relative rates of COVID-19 among residents and staff for facilities with lower liquidity and those that experienced more adverse cash flow shocks. These tests lend support to our hypothesis that financially weaker facilities are less able to invest in risk mitigation and, therefore, have less of a barrier to prevent transmission

of COVID-19 across groups.

We further examine the spread of COVID-19 between staff and residents within a given facility by examining cross-contamination more generally. For these tests, we focus only on facilities with at least one resident or one staff case of COVID-19. Conditional on one group having COVID-19, we examine the relationship between the financial factors of interest and whether both groups end up having at least one case of COVID-19 (which we call cross-contamination) within weeks of one another. The motivation is similar to the within-facility analysis: facilities with stronger liquidity and cash flow can invest more in risk mitigation and limit cross-contamination. Consistent with our other results, we find facilities with low ex-ante liquidity and those that experience more adverse cash flow shocks have higher cross-contamination rates.

To further examine the role of financial constraints, we examine whether facilities that were more likely to be financially constrained had a differential sensitivity between the shock to cash flows or ex-ante liquidity and COVID-19 incidence. Examining this differential sensitivity across differing degrees of financial constraints allows us to directly control for any baseline relationship between Medicare share (or ex-ante liquidity) and COVID-19 and control for unobserved heterogeneity across facilities common to both staff and residents. We use nursing home size as a proxy for financial constraints (Hadlock and Pierce, 2010). We find a stronger relationship between the relative likelihood of COVID-19 (residents compared to staff) and adverse shocks to cash flow among smaller, more constrained nursing homes than for larger nursing homes. We find similar results for days-cash-on-hand. These results highlight the role of financial constraints in explaining the differences in COVID-19 incidence across nursing homes.

Overall, we provide evidence that a nursing home's degree of liquidity and the magnitude of the pandemic's negative shock to nursing homes' revenues have economically meaningful relationships with the likelihood of the incidence of COVID-19. Federal and state governments

have taken some actions to partially help address the challenges faced by nursing homes during the pandemic. Many of the programs were established or implemented a month or more after the beginning of the outbreak. These government programs, which we discuss in more detail in the paper, may have helped mitigate some of the negative relationship between nursing home finances and COVID-19 prevention. However, our results suggest the actions were either not early enough or large enough to offset the relationship between the negative financial shock and COVID-19 incidence. More broadly, our results indicate that the financial strength of a firm has important consequences for all stakeholders of the firm – including non-financial stakeholders – to navigate and emerge from the pandemic safely.

Our paper contributes to the literature examining how firm financing affects non-financial stakeholders. Examining the relationship between firm financing and employee safety, Cohn and Wardlaw (2016) provide evidence that financially constrained firms have higher employee injury rates, and Nie and Zhao (2017) find a negative relationship between a firm's leverage and worker safety. Cohn and Deryugina (2018) provide evidence that financially constrained firms are more likely to experience environmental spills. A large related literature examines the relationship between firm financing and product quality[3] with a recent example from the healthcare sector of Adelino, Lewellen, and McCartney (2020) who find that treatment choices in nonprofit hospitals are related to financing constraints. We also relate to growing work on firms' financial flexibility and firm outcomes during the COVID-19 pandemic (e.g., Fahlenbrach, Rageth, and Stulz, 2020; Ramelli and Wagner, 2020). We add to these literatures by examining a setting where the firm's decisions can literally mean life or death for its customers and employees. The swift and substantial nature of the COVID-19 shock helps draw a strong link between firm finances and these important outcomes. We are the first paper to document how firms' financial constraints can affect the risk exposure to customers. In our context, the risk is the spread of a deadly disease – leading to severe negative consequences

[3]See, for example, Rose (1990); Maksimovic and Titman (1991); Chevalier (1995); Phillips (1995); Chevalier and Scharfstein (1995); Dionne, Gagné, Gagnon, and Vanasse (1997); Campello (2003); Matsa (2011); Phillips and Sertsios (2013); Kini, Shenoy, and Subramaniam (2017).

for both customers and society more generally.

Our paper also contributes to a growing body of work examining nursing home characteristics and COVID-19 cases. Abrams, Loomer, Gandhi, and Grabowski (2020) and White, Kosar, Feifer, Blackman, Gravenstein, Ouslander, and Mor (forthcoming) also document the relationships between a nursing home's size and location and COVID-19 likelihood. Chen et al. (2020) show the importance of staff linkages across nursing homes for predicting COVID-19 outbreaks. Prior work is mixed on whether a nursing home's ratings, prior infection violations, and racial composition of residents are related to COVID-19 cases (Abrams et al., 2020; White et al., forthcoming; Konetzka, 2020; He, Li, and Fang, 2020). The variables studied in these papers help to motivate our set of control variables and our null hypothesis. Our main contribution to this literature is to empirically establish the relationship between the finances of nursing homes and the incidence of COVID-19.

2 Nursing Homes and the COVID-19 Pandemic

2.1 Skilled Nursing Facilities

Our analysis focuses on "skilled nursing facilities," which we call nursing homes. Residents of these facilities have needs such as general rehabilitation after injuries or surgeries, recovery from stroke, Parkinson's care, and custodial or terminal illness care. Much of the population of these facilities have one or many of the risk factors that make them most vulnerable to COVID-19: over 84% of nursing home residents are over 65 years of age, one-third of residents have diabetes, over one-third have heart disease, and nearly three-quarters have high blood pressure.[4] These residents require a significant amount of close, in-person, physical interaction with nursing home employees, which makes it impossible to socially distance and amplifies

[4]Characteristic statistics are from Harris-Kojetin, Sengupta, Lendon, Rome, Valverde, and Caffrey (2019), and risk factors are listed on the CDC website: "Assessing Risk Factors for Severe COVID-19 Illness", CDC, https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/assessing-risk-factors.html

the importance of adequate protective equipment and other preventative, risk mitigation measures to limit residents' and employees' possible exposure and spread of the disease.

The nursing homes that we examine play an important role in the broader long-term care services sector in the United States. In 2016, there were 15,600 nursing homes in the United States, while there were 4,600 adult day service centers, 12,200 home health agencies, 4,300 hospices, and 28,900 assisted living and residential care communities (Harris-Kojetin et al., 2019). Assisted living and residential care communities are similar to nursing homes on many dimensions (e.g., resident age demographic, high-density living), but do not typically provide the same level of skilled medical care provided in a nursing home.[5] We focus on nursing homes with skilled nursing facilities due to data availability – only Medicare and Medicaid-certified nursing facilities have to report their COVID-19 cases to the CMS. However, the trade-offs we document are likely to be present in the rest of the elder-care industry and other settings where the nonfinancial stakeholders' welfare depends on costly financial investment.

2.2 Paying for Nursing Home Care

The nursing homes in our sample have three main categories of patient types: short-term residents covered by Medicare, long-term residents covered by Medicaid, and residents covered by private sources. Medicare covers short-term post-acute care following a stint of at least three qualifying days in an inpatient acute care setting.[6] Medicare covers the full cost of post-acute care for up to 20 days. After 20 days, residents must pay a daily co-pay ($170.50 per day in 2020). After 100 days, Medicare no longer provides coverage.[7] The median Medicare stay for a resident in our sample is 35 days. Residents that require care for longer

[5]Assisted living communities are not Medicare-certified, and only around half are Medicaid-certified (Harris-Kojetin et al., 2019). In contrast, 97.5% (95.2%) of nursing homes were Medicare (Medicaid) certified in 2016 (Harris-Kojetin et al., 2019).

[6]This requirement was waived during the pandemic to help relieve bed capacity at hospitals. Although there was confusion about whether the waiver applied to all skilled nursing facilities or only for transfers from hospitals needing to create bed capacity, the waiver technically applied to all skilled nursing facilities in the country (Buck, 2020).

[7]https://www.medicare.gov/Pubs/pdf/10153-Medicare-Skilled-Nursing-Facility-Care.pdf

than the Medicare coverage period transition to "private pay," which is typically out-of-pocket (Brown and Finkelstein, 2011), if they have the financial resources. Those with insufficient financial resources typically transition to Medicaid-coverage. In our sample, 13% of inpatient days are covered by Medicare, 54% are Medicaid, with the remainder private-pay.

Medicare reimbursement rates far exceed the Medicaid reimbursement rates. The National Investment Center for Seniors Housing & Care (2020) estimated the average revenue per patient day in the first quarter of 2020 was $540 ($425) for Medicare (Managed Medicare), $220 for Medicaid, and $275 for private-pay. The difference in reimbursement rates means Medicare is a disproportionate source of revenue for nursing homes. In the first quarter of 2020, Medicare accounted for less than 20% of inpatient days but over 30% of revenue (National Investment Center for Seniors Housing & Care, 2020). The low Medicaid reimbursement rate leads many nursing homes to use their more profitable short-term Medicare business to cross-subsidize their Medicaid residents. Grabowski and Mor (2020) state that "many nursing homes only stay in business by subsidizing long-term Medicaid residents with short-term post-acute care."[8] We discuss in Section 2.3.2 how the share of Medicare-covered residents is a key determinant of the size of the negative shock to that nursing home's financial strength during the COVID-19 pandemic.

2.3 COVID-19 Pandemic and Nursing Home Finances

The COVID-19 pandemic has dealt a damaging blow to an industry whose financial footing was already fragile. Many of the strategies to mitigate the risk of nursing home residents catching COVID-19 require significant expenditures, and these outlays come at a time of overall flagging cash flow and economic prospects.

[8]The differentials in reimbursement rates means nursing homes have an incentive to discriminate in admissions against residents that are Medicaid-eligible with long anticipated stays (Gandhi, 2019).

2.3.1 Increasing Labor, PPE, and COVID-19 Testing Costs

The AHCA and NCAL (American Health Care Association and the National Center for Assisted Living, 2020) listed a number of ways in which COVID-19 has increased nursing homes costs:

> "Labor costs related to overtime, agency costs, new screening requirements for staff and outside health care workers, more staff to address communal mean restrictions, staff time for family communication (i.e., assistance with iPad, etc.), staff out due quarantine or school closures, substantial increases in PPE costs and supplier requirements to pay upfront in full for PPE, and new child care costs being paid by SNFs for employees."

Analysis by Argentum (2020) estimated non-labor costs for facilities in the elder-care industry would increase 73-103 percent. The same report projected labor costs to increase 8-18 percent as a result of the pandemic.

A critical tool for risk mitigation is the purchase and proper use of personal protective equipment (PPE). Health care providers, governments, and others across the world competed for scarce PPE resources. The price of PPE increased over 1,000% by April, with the price of 3M N95 masks increasing over 6,000% (Society for Healthcare Organization Procurement Professionals, 2020). In early April, the Society for Healthcare Organization Procurement Professionals estimated that following CDC guidelines for PPE would cost a 100-bed facility $10,000 per day (Flynn, 2020b). For context, this breaks down to $100 per bed per day, which would consume nearly half of the average daily Medicaid reimbursement of $220 per resident. Some nursing homes that usually spend between $20,000-$25,000 per *year* on PPE were spending close to $100,000 per *month* on PPE (Flynn, 2020b).

Another significant expense related to risk mitigation was COVID-19 testing for residents and employees. Guidelines and requirements on testing in nursing homes varied across

states, but many states required or strongly recommended testing all residents and staff at a high frequency. AHCA and NCAL estimated that testing every nursing home resident and employee in the nation *one time* would cost $440 million. While Medicare reimburses certain COVID-19 tests at a rate of $100 (only $51 until mid-April), the AHCA and NCAL estimated the cost per test at $150, meaning a significant portion of the cost may be born by the nursing facilities, other local government support, or private insurance. Even into June 2020, there remained uncertainty about who would bear the costs associated with testing, especially the testing of employees (Thomas, 2020).

2.3.2 Patient Mix and the Negative Shock to Cash Flows

Almost all nursing homes faced a significant drop in revenue during the early months of the COVID-19 pandemic, but not all were equally affected. The main driver of the revenue loss was the sharp decline in the inflow of new residents, which occurred for at least two reasons. First, some nursing homes decided to limit or completely ban any new residents as a preventative measure. Second, there was a sharp drop in elective procedures (e.g., joint replacements) beginning as early as March 2020 due to voluntary and government-mandated restrictions. The significant decline in elective procedures led to a sharp decline in Medicare post-acute care (PAC) residents for nursing homes, which is the highest turnover and most profitable customer segment.[9] We later empirically show the strong relationship between a nursing homes' share of pre-pandemic business that is reimbursed by Medicare and declines in their residents (Figure 2 in Section 3.3). In addition to the immediate declines in resident inflows, there was significant uncertainty about the duration of the elective procedure bans and how quickly nursing home demand would spring back. Even after the first wave, there remained concerns about whether similar actions might be taken if in the event of subsequent waves.

[9]Industry expert Fred Bentley states, "It's definitely a hit. These are Medicare fee-for-service Part A residents. This is SNFs' [nursing homes'] lifeblood. They depend on that business to cross-subsidize Medicaid business... They count on the short-stay business to offset [Medicaid] losses." (Berger, 2020)

In sum, nursing homes experienced adverse shocks to their resident inflows and, in turn, their revenues, cash flows, and firm value. Nursing homes more reliant on Medicare-covered residents were harder hit by the stoppage of elective procedures. Thus, we use the pre-pandemic Medicare share of residents in the nursing home to measure the severity of the negative cash flow shock brought on by the pandemic in our empirical analysis.

2.3.3 Government Aid to Nursing Homes

Federal and state governments have created new programs and used existing programs to help address the economic impacts of the COVID-19 pandemic. The nursing homes in our sample qualified for a number of these programs. The three main federal programs providing financial assistance to nursing homes were the Medicare Accelerated and Advance Payments Program, the Paycheck Protection Program, and the Provider Relief Fund. The main intervention at the state-level came in the form of increased Medicaid reimbursement rates.

The Medicare Accelerated and Advance Payments Program (MAAPP) is a loan program administered by the CMS to Medicare-certified providers (which includes all of our sample). In previous instances, the program has provided advance and accelerated payments to Medicare providers in locations affected by a natural disaster. On March 28, 2020, the program was expanded to all Medicare providers (e.g., physicians, hospitals, nursing homes, etc.), with the loan repayment to begin 120 days after the loan issuance date. The purpose of this program was to provide liquidity to healthcare providers at the onset of the pandemic. The maximum loan amount for nursing homes was three months' worth of Medicare payments, so those with greater Medicare revenue were eligible for greater loan amounts through this program. The repayment process is automated and effectively garnishes payment of future Medicare claims until the balance is repaid. On April 26, 2020, the program was suspended and being re-evaluated as the CARES Act Provider Relief Fund provided a more generous form of

government support for Medicare providers.[10]

Beyond MAAPP, the federal government also provided cash grants to all qualifying small businesses through the Paycheck Protection Program and specifically provided grants to health care providers through the Provider Relief Fund. The grant's size was based on either payroll costs (Paycheck Protection Program) or total revenues and the number of beds (Provider Relief Fund). The Provider Relief Fund came into effect relatively late with the main, targeted disbursement to nursing homes occurring on May 22, 2020. Unlike MAAPP, relief from these programs was mainly based on nursing home size and payroll and did not depend on the types of residents at the nursing home. We provide more details on these programs in the Appendix.

At the state level, 24 states had taken actions to enhance Medicaid reimbursement rates for nursing homes as of June 12, 2020 (Flynn, 2020a). The enhanced payments typically took the form of a percentage increase (e.g., Rhode Island, Connecticut, and Oregon increased rates by 10%) or a flat rate increase (e.g., Washington increased the Medicaid rate by $29 per day). The date of the rate increase varied significantly across states (between April and June), and many were applied retroactively. For example, on May 13, California increased rates by 10%, and this rate increase was effective from March 1st through the end of the public health emergency.[11] While these are undoubtedly helpful interventions, most of the states that provided such assistance did so a month or two after many of the most difficult decisions on risk mitigation were made at the outset of the pandemic.

Finally, in May the Pentagon, FEMA, and CMS coordinated the purchase of PPE to distribute to nursing homes. By all indications, the government-provided PPE came too late or was insufficient to address PPE needs for most nursing homes. Reports in the popular press documented significant concerns about the provided PPE's quality and quantity (Mathews,

[10]Further details: https://www.cms.gov/newsroom/press-releases/trump-administration-provides-financial-relief-medicare-providers, https://www.cms.gov/files/document/Accelerated-and-Advanced-Payments-Fact-Sheet.pdf

[11]Flynn (2020a) provides further details on Medicaid enhancements by state.

2020).

Despite these programs, the industry was still in poor financial condition. As of early August 2020, a survey of nursing homes showed that 72% of nursing homes said they could not sustain operations at their current pace for another year, and 40% said they would last less than six months (AHCA NCAL, 2020).

3 Hypothesis Development

In the face of the COVID-19 pandemic, the nursing homes' have faced significant challenges. Within a relatively short time window, management has had to evaluate the costs and benefits of increased spending on preventative measures such as PPE, changing visitation and admittance policies, and the frequency of testing for COVID-19 of residents and staff as other issues. At the same time, some major sources of revenue and profits were sharply dropping. Management was forced to make tough decisions on how to allocated limited resources. For example, with falling revenues and high testing costs for workers, "some are electing not to engage in widespread testing" (Kris, Molony, and Schulman-Green, 2020). Low levels of investment in risk mitigation, either by choice or because of constraints, inherently put their residents at a higher risk of contracting COVID-19. In the subsections below, we outline the role that financial factors may play in the spread of COVID-19.

3.1 Liquidity and COVID-19

The typical nursing home operates with razor-thin margins (with median operating margin at 1%) and has relatively little cash on hand. Nursing homes with low liquidity may desire to raise costly external capital if they wish to invest in greater risk mitigation. Unfortunately, given the time-sensitive nature of the unfolding pandemic and deteriorating financial prospects of nursing homes, most were unlikely to quickly access large amounts of external capital.

Such factors may hinder quick and significant risk mitigation investments and elevate the likelihood of COVID-19 in a nursing home. This motivates our first hypothesis:

Hypothesis 1: *Liquidity-constrained nursing homes are more likely to have COVID-19 cases.*

3.2 Negative Financial Shocks and COVID-19

The COVID-19 pandemic has been a major negative cash flow shock for nursing homes, which can limit nursing homes' ability to fund risk mitigation investments. There are at least three ways in which these financial conditions can translate into a higher incidence of COVID-19. First, lower internal cash flow may mean that nursing homes' simply cannot find the resources to fund risk mitigation, especially when PPE prices were so high. Second, most nursing homes have very high operating leverage (fixed salary and lease expenses). With the prospects of declining revenue and firm value, a form of the debt overhang problem may have led to underinvestment problems in risk mitigation (Myers, 1977). Third, this shock to firm value could also give rise to "risk-shifting" incentives (Jensen and Meckling, 1976). As a nursing home approaches insolvency or financial distress, the nursing home can save cash by delaying or forgoing high levels of risk mitigation investments with much of the remaining unmitigated risk being borne by stakeholders other than management and equity holders – namely, debt holders, residents, and employees. These factors motivate our second hypothesis:

Hypothesis 2: *COVID-19 is more likely to occur in nursing homes that experience larger adverse shocks to cash flows.*

We examine this hypothesis by using nursing homes' ex-ante Medicare share of residents to measure the degree of the nursing home's adverse shock to cash flow during the pandemic. As discussed in Section 2.3.2, the stoppage of elective medical procedures at the onset of the

pandemic, likely translated to a larger loss in residents and thus cash flow for nursing homes with greater ex-ante reliance on Medicare residents. In Figure 2, we present a binned scatter plot of percent change in nursing home residents around the timing of elective surgery bans (from January to June 2020) as a function of the nursing home's pre-pandemic *MedicareShare*, while controlling for a number of other nursing home characteristics and county fixed effects. The figure shows a stark relationship, where higher pre-pandemic *MedicareShare* corresponds to larger drops in residents. This lends empirical support for our use of *MedicareShare* as our measure of the severity of the negative cash flow shocks suffered by nursing homes during the pandemic.

3.3 Financial Constraints and COVID-19

Finally, larger nursing homes likely have greater access to external financing (Hadlock and Pierce, 2010) to fund investments in risk mitigation. Smaller nursing homes are typically more dependent on internally generated funds for investment for reasons such as asymmetric information (e.g., see Fazzari, Hubbard, Petersen, Blinder, and Poterba, 1988; Whited, 1992). If the financial constraint binds more for smaller facilities, this will lead to a relatively higher sensitivity of COVID-19 incidence to negative cash flow shocks or to lower ex-ante liquidity for smaller facilities.

Hypothesis 3: *The relationship between COVID-19 and ex-ante liquidity or adverse shocks to cash flows is strongest for smaller, financially constrained nursing homes.*

We test for the presence of a differential relationship between COVID-19 and ex-ante liquidity or shocks to cash flow according to the degree of financial constraints as measured by the facility's total inpatient days (i.e., size).

4 Data Sources and Summary Statistics

The Centers for Medicare & Medicaid Services (CMS) collects and disseminates a significant amount of information about Medicare and Medicaid-certified homes. The majority of our data are from the CMS.

4.1 COVID-19 Cases

The main outcome we study is whether a nursing home has at least one case of COVID-19 during the first months of the pandemic. The potential for rapid spread of COVID-19 within an environment like a nursing home makes examining whether it enters a nursing home at all of first-order importance. We also examine the total number of cases, the incidence of COVID-19 deaths, and the total number of COVID-19 deaths in additional tests.

The data on nursing home COVID-19 cases comes from the CMS's COVID-19 Nursing Home Data, which is reported through the CDC's National Healthcare Safety Network (NHSN) system's COVID-19 Long Term Care Facility Module.[12] Reporting is mandatory, and those failing to report are subject to enforcement actions. The data are updated weekly since May 24, 2020. The nursing homes report both cumulative resident cases and deaths as well as weekly data.[13] Nursing homes report similar data for nursing home staff, which we use in some of our tests.

The CMS performs data quality checks to ensure the nursing homes have not entered incorrect data. If the CMS flags a nursing home as having entered incorrect information, the nursing home is excluded from the dataset. After the initial release of data, a set of

[12] https://data.cms.gov/stories/s/COVID-19-Nursing-Home-Data/bkwz-xpvg/

[13] We use *Residents Total Confirmed COVID-19*, which is defined as the "number of residents with laboratory positive COVID-19 (CONFIRMED) since 01/01/2020 as reported by the provider." Some facilities may have chosen to only report cases active at the end of April and then all new cases thereafter. We focus on the presence of any cases at all and not cumulative case counts. To misclassify our main variable, it would have to be the case that a nursing home had cases in March or early April, but no active cases by or after the end of April, which we think is unlikely. Further, we conduct within-facility tests that would directly account for any such reporting decisions.

nursing homes raised concerns that their data had errors (Clark, 2020). The CMS corrects any identified errors, and so newer vintages of the data are of higher quality. We use data as of the week ending October 18, 2020, which we select because it represents a relative minimum in new nursing home cases before the onset of the fall wave of cases. Our results are robust to using alternative dates.

4.2 Operational and Financial Data

The CMS provides databases that form the Healthcare Cost Report Information System (HCRIS). All Medicare providers must annually submit detailed cost reports that include facility identifying information and characteristics; the payor mix of those they serve (e.g., Medicaid, Medicare); capacity and utilization data; cost and charges by cost center; and financial statement data. Specifically, we collect the raw data from form CMS-2540-10. These data consist of nearly 20,000 raw data fields, of which about 1,200 are populated for most nursing homes. The CMS has made efforts to ensure the data are up-to-date and accurate, and we also perform necessary data cleaning to remove obvious data errors. For example, after creating the variables for analysis, we trim values that are more than five interquartile ranges above the 75th percentile or below the 25th percentile.[14] We use the data reported from 2019, the most recent year pre-pandemic.

4.3 Nursing Home Ratings

The CMS uses a star rating system to rate nursing homes. There are four main star ratings: overall, health inspection, quality of resident care, and staffing. The overall rating is based on the nursing home's rating in the other three categories, with the health inspection

[14]This data cleaning process is similar to what is used by the RAND Corporation to clean Hospital HCRIS data (https://www.hospitaldatasets.org/faq). We trim these rather than winsorize as the algorithm is more likely to capture data errors rather than identify true outliers. The results are not sensitive to using alternative methods of data cleaning.

rating being the most important component.[15] The health inspection rating is based on the number of citations identified during annual health inspections, or during any complaint or facility-reported incident investigations over the past three years. The health inspection star rating is based on the nursing home's percentile rank within its state (e.g., the top 10% are given 5 stars, the bottom 20% are given 1 star). The staffing rating is based on registered nurse and total staffing hours per resident per day. The quality of resident care star rating is based on a combination of quality measures derived from nursing home reported data and Medicare claims data. CMS calculates separate quality-of-care ratings for short-stay, long-stay, and overall. In our analysis, we examine whether these CMS nursing home ratings are associated with the likelihood of a nursing home having a COVID-19 case. They also allow us to control for such quality factors that are unobserved by the econometrician. In robustness tests, we find similar results when controlling for ratings developed by an independent firm, IntegraMed Analytics.[16]

4.4 Other Data Sources

We obtain data on county-level COVID-19 cases from the New York Times to measure the local baseline exposure to COVID-19.[17] We obtain five-digit zip-code-level measures of average household income and minority share of the local population from the 2019 American Community Survey. We use data on foot-traffic to the nursing home using mobility data provided by SafeGraph.[18] SafeGraph's data covers approximately 10% of mobile devices in the United States, and their sample demographics correlate very highly with Census

[15]For details on the exact calculations of the star ratings, see https://www.medicare.gov/nursinghomecompare/Data/About.html.

[16]IntegraMed produces ratings that are less susceptible to potential self-reporting bias by leveraging Medicare data from hospitals that treat nursing home patients. See https://www.nursinghomereporting.com/.

[17]The data are available at https://developer.nytimes.com/covid. As a check of the quality of the New York Times data, we correlate the county-level COVID cases variable from their data with the county-level confirmed cases variable from usafacts.org and find a correlation of 0.9995.

[18]SafeGraph (http://SafeGraph.com), is a data company that aggregates anonymized location data from numerous applications in order to provide insights about physical places, via the Placekey Community (http://Placekey.io). To enhance privacy, SafeGraph excludes census block group information if fewer than five devices visited an establishment in a month from a given census block group.

demographics.[19]

4.5 Sample Selection and Summary Statistics

We start with a sample of over 14,000 skilled nursing facilities (nursing homes) from the most recent complete CMS cost reports data prior to the onset of the pandemic (2019). We then drop government-run nursing homes (about 1,100). We exclude observations with data values that appear to be erroneous (using the procedure in Section 4.2). We drop nursing homes that are the only nursing home in their county since our main tests include county fixed effects and so require within-county variation. Our final sample consists of 7,347 nursing homes from 1,257 counties.

We use a common industry measure of liquidity and a measure of the cash flow shock experienced by nursing homes during the pandemic and examine whether these variables are associated with a higher incidence of COVID-19. The liquidity measure is "days-cash-on-hand," which is a widely-used measure in healthcare finance to capture the factors that truly determine the liquidity of the business (Gapenski and Reiter, 2016). We compute days-cash-on-hand as $\frac{cash\ and\ short\text{-}term\ investments}{(operating\ expenses\ -\ depreciation)/365}$, which is the number of days' worth of real operating expenses that can be supported by the nursing home's most liquid assets.

We use the pre-COVID-19 share of inpatient days covered by Medicare as our measure of the shock to nursing homes' cash flow. Nursing homes with a greater share of their residents covered by Medicare experience a larger shock to cash flow because the flow of these residents dropped sharply as a consequence of elective procedure bans (see Figure 2).

Table 1 presents the sample summary statistics. 73% of nursing homes in our sample had at least one case of COVID-19 among residents as of October 18, 2020. Examining our main cross-sectional variables of interest, we see the average nursing home in our sample has only 24 days of cash on hand with an interquartile range of 29 days. Medicare covers about 13%

[19] https://www.safegraph.com/blog/what-about-bias-in-the-safegraph-dataset

of the average nursing home's inpatient days. From January to June 2020 (i.e., during the onset of the pandemic and sharp restrictions on elective procedures), we also see an average drop in residents of about 11% with significant variation around that figure.

Table 1 also provides summary statistics for other variables we use in our analysis. We control for variables related to facility size (*InpatientDays* and *Employees*), operational ratings (*Overall Rating* and *Health Inspection Rating*), as well as other financial variables (*TotalMargin* and (book) *Leverage*) of the nursing home. One notable observation is how tight margins were in the nursing home business leading up to the pandemic, with a median total margin of 1% and the average at 0%.

Table 2 presents a correlation matrix for the nursing home characteristics. We make a couple brief observations about *MedicareShare* for which higher values represent a larger negative shock to cash flows as a result of elective procedure bans from the onset of the pandemic. First, *MedicareShare* has relatively little correlation with the liquidity position of the nursing home (*DaysCashOnHand*). Second, high *MedicareShare* facilities typically have higher overall and health inspection quality ratings.

5 Results

In this section, we begin by establishing the baseline drivers of variation in the incidence of COVID-19. Next, we examine whether a nursing home's liquidity position and the degree of the negative shock to the nursing home's business relates to the likelihood of a COVID-19 case in the nursing home. We then perform within-facility tests that allow us to examine how these variables are related to cross-contamination from staff to residents and vice versa while accounting for nursing-home-specific unobserved heterogeneity. Finally, we test whether these relationships are stronger for more financially constrained facilities.

5.1 Baseline Regressions

We begin the analysis by considering some of the baseline variables that represent differences in exposure to COVID-19. The most prominent factor is the location of the nursing home. Facilities in areas with greater community spread of the coronavirus are more likely to be exposed to the virus and have a case of COVID-19. Figure 3 shows the strong relationship between cases in a county and cases in that county's nursing homes. A second baseline factor is the size of the nursing home. Nursing homes with more residents on a given day and more employees will have greater scope for transmission and a COVID-19 case than other homes. We use the (logarithm of the) number of inpatient days (*log(Inpatient Days)*) – which is simply the sum across residents of the number of days each patient was served – to capture the size of the nursing home and the (logarithm of the) number of full-time employee equivalents (*log(Employees)*) to capture the size of the nursing home's workforce. A third potentially important factor is the nursing home's general quality, which we measure by CMS overall ratings and health inspection ratings.

For our first set of tests, we use the OLS framework below:

$$\textit{COVID-19}_{i,c} = \alpha + \Gamma(\textit{NursingHomeCharacteristics}_i) + \kappa_c + \epsilon_{i,c}, \tag{1}$$

where $\textit{COVID-19}_{i,c}$ is a dummy variable equal to one if nursing home i in county c has at least one case of COVID-19 among residents by October 18, 2020. $\textit{NursingHomeCharacteristics}_i$ is a set of nursing home characteristics, and κ_c are county fixed effects. The county fixed effects account for fixed differences in local exposure to COVID-19 and differences in local and state-level factors including the degree of restrictions on elective surgeries, labor laws, Medicaid policies, and stay-at-home orders.[20] We compute standard errors clustered at the

[20]In Appendix Table A1, we show that all of our main results are robust to using different levels of geographical fixed effects. We find that the relationship between financial variables and COVID-19 is robust to using state, CBSA, or even city-level fixed effects. The variables of interest remain economically and statistically significant across specifications.

county level.

Table 3 presents the results. Column (1) only includes the logarithm of the number of COVID-19 cases in the county (excluding those in nursing homes) in the regression. There is a strong positive relationship between local COVID-19 cases and the likelihood of a COVID-19 case in a nursing home in that county This variable alone explains about 11% of the variation. In column (2), we regress *COVID-19* on county fixed effects, and the R^2 increases to 37%.

In column (3), we include *log(Inpatient Days)* and *log(Employees)* to capture the size and degree of people and human interactions at the nursing home. We find a strong relationship between *log(Inpatient Days)* and the likelihood of a COVID-19 case, but *log(Employees)* is not significantly related to the likelihood of a COVID-19 case after controlling for location and inpatient days.[21]

We next consider the role of a nursing home's quality ratings as assigned by the CMS. Column (4) includes indicator variables for each level of the CMS 5-star overall rating, with the 1-star dummy omitted. We find variation in the incidence of a COVID-19 case is only weakly negatively related to the facility's overall star rating, with 5-star facilities having an average of 3.6 percentage points lower likelihood than 1-star facilities (p-value of 0.05). The overall star rating comprises ratings related to health inspections, staffing, and other quality sub-ratings. The health inspection rating is the most important component of the overall rating. The estimates in column (5) show economically meaningful differences according to the health inspection rating (as of January 2020). Those facilities rated 4- and 5-stars have 3.5 and 4.9 percentage points lower incidence of COVID-19, respectively compared to the lowest-rated nursing homes. In untabulated tests, we find no significant difference in COVID-19 incidence across staffing or quality ratings. For the remainder of our tests, we only include indicators for the health inspection ratings.

[21] If *log(Inpatient Days)* is omitted from the regression, the coefficient estimate on *log(Employees)* is 0.14 (p-value$<$0.01).

5.2 Financial Factors and COVID-19

We now examine whether financial factors can explain the variation in the likelihood of a COVID-19 case in a nursing home as laid out in Hypotheses 1 and 2. To examine the roles of low ex-ante liquidity and the negative cash flow shock on the likelihood of COVID-19 incidence, we include *log(DaysCashOnHand)* and *MedicareShare* in our baseline regression model (1). Table 4 presents the results.

Column (1) shows a strong, negative relationship between the nursing home's liquidity position and COVID-19, supporting Hypothesis 1. Lower liquidity – thus, fewer financial resources to immediately deploy for risk mitigation – corresponds to a higher likelihood of COVID-19. Dropping from the 75th to 25th percentile of days-cash-on-hand corresponds to a roughly 2.3 percentage point higher likelihood of COVID-19 at the nursing home. We do not find a significant relationship between margins or leverage and COVID-19. This may not be particularly surprising given that other work examining the financial health of nursing homes has found that leverage measures are relatively uninformative in predicting financial distress (Lord, Landry, Savage, and Weech-Maldonado, 2020).

Column (2) examines the relationship between COVID-19 incidence and the negative cash flow shock from having a higher reliance on Medicare residents, supporting Hypothesis 2. Greater decline in cash flows – thus, lower internally-generated cash flow to support risk mitigation – were more likely to have a COVID-19 case. The estimates indicate that a 10 percentage point increase in Medicare share corresponds to a 3.17 percentage point increase in the likelihood of COVID-19. Column (3) shows that this relationship is relatively independent of the liquidity result found in column (1).

5.2.1 Robustness and Other Potential Explanations

There may be lingering concerns that high *MedicareShare* or low liquidity facilities are located in areas within a county that are more susceptible to COVID-19. For instance, there

may be variation in demographic variables that relate to issues such as culture of compliance with public health mandates within a county that are also related to Medicare share or ex-ante liquidity. We first note that there is no obvious reason why higher-*MedicareShare* facilities would be systematically correlated with such variables. Second, in the Appendix Table A1, we show our results are robust to using city-level fixed effects, which compares outcomes within an even finer geographical footprint. Lastly, in column (4), we include zipcode level minority share and the logarithm of average income as additional controls and find nearly identical coefficients for our main variables of interest.[22]

Another potential concern is that higher-*MedicareShare* nursing homes may have higher patient turnover and traffic, and such (nonfinancial) factors increase COVID-19 exposure. This is unlikely for a few reasons. First, we find that higher *MedicareShare* facilities experienced substantially larger occupancy *decreases* during the pandemic with the stoppage of elective procedures, and this mechanically leads to decreased patient traffic.

Second, we address this empirically by adding potential baseline differences in foot traffic to each facility (the logarithm of the number of visitors between December 2019 and March 2020) as a control variable in the regression in column (5).[23] We also include a measure of resident density in the regression in column (5) (building square feet per resident) to address any concerns that higher-Medicare-share facilities are more densely populated and more susceptible to COVID-19 among residents. The inclusion of these controls has minimal impact on the coefficient estimates of interest.

Are differences in the capabilities or patient demographics – and thus potential differences in baseline susceptibility to COVID-19 – driving the results? In column (6), we control for several variables related to a nursing home's ability to handle more complicated cases (the additional data requirements cause us to lose about 1,000 nursing homes). We include

[22]We use minority share because minority populations have been shown to be disproportionately affected by the pandemic (Li, Cen, Cai, and Temkin-Greener, 2020; Gold, Rossen, Ahmad, Sutton, Li, Salvatore, Coyle, DeCuir, Baack, Durant, et al., 2020)

[23]Our results are also robust to controlling for foot traffic after the onset of the pandemic.

average Hierarchical Condition Categories (HCC), a risk adjustment factor where higher HCC usually indicates higher-cost, higher severity residents. We also include another measure of rehabilitation intensity, *Share>VeryHigh*. In addition, we include the share of Medicare residents with stays less than 30 days, stays longer than 60 days, share using Medicare Advantage, and shares with asthma, congestive heart failure, COPD, and whether their primary condition for residency is congestive heart failure, COPD, infection, or injury. These variables should account for a nursing home's technology, expertise, and hospital relationships. We also control for the demographics of Medicare residents admitted to the nursing homes (average age, percent male, and percent minority). Again, we find that controlling for these factors has only a small effect on the *log(DaysCashOnHand)* and *MedicareShare* coefficient estimates.

During a surge of COVID-19, some states have had the capacity of their hospital systems and intensive care units (ICUs) severely strained, leading to direct or indirect pressure for nursing homes to admit residents who had COVID-19. Could our results be driven by this pressure disproportionately falling on higher-Medicare-share nursing homes within a given county? In untabulated tests, we re-estimate our main regressions while excluding nursing homes in states that exceeded 80% of hospital ICU capacity during our sample period.[24] We find similar results in magnitude and statistical significance.

As size is an important factor in the incidence of COVID-19, there may be concerns that the results are not robust to alternative functional forms of log(InpatientDays). In untabulated results, we find our key estimates are virtually unaffected by considering several alternative flexible functional forms for size including higher order polynomials and including 50 dummy variables for equal-sized partitions of the size distribution.

[24]These tests use data from the CDC on hospital ICU utilization.

5.2.2 Alternative COVID-19 Outcome Measures

In Appendix Table A2, we run similar tests with three additional COVID-19 outcome measures. We examine whether at least one resident suffers a COVID-19-related death, the number of COVID-19 cases, and the number of COVID-19-related deaths. For the non-binary outcome measures, we use an inverse-hyperbolic sine transformation of the dependent variable (similar to Chen et al., 2020) to avoid dropping observations with zero COVID-19 cases. While our main measure of interest captures the initial entry of the virus into the nursing home, these other measures capture both the initial entry and the severity of the spread and ultimate outcome. We find similar results.

5.3 Within-Facility Tests

COVID-19 typically enters a nursing home through the staff (New York State Department of Health, 2020; Chen et al., 2020). The risk mitigation measures (e.g., masks) act as a barrier to inhibit transmission particularly between staff members and nursing home residents. In settings where risk mitigation is the top priority, creating such barriers would effectively seal off staff cases from resident cases, predicting virtually no correlation between COVID-19 incidence between staff and residents within nursing homes. Alternatively, without risk mitigation, "cross-contamination" across groups within a nursing home would be prevalent. For example, infection among the staff population would inevitably lead to infection among the resident population. We next examine differences in the incidence of COVID-19 between residents and staff and see how it relates to the financial variables of interest.

We use an approach similar to a "first-difference" regression where the outcome variable is the difference between COVID-19 incidence among residents minus COVID-19 incidence in staff within the same nursing home. By taking differences, we eliminate any unobserved nursing-home-specific drivers of COVID-19 that shift the levels of incidence of COVID-19 similarly across staff and residents. Such factors could include the facility's culture of

compliance, ease of movement in the facility, visitation policies, or sophistication.

We estimate the following regression:

$$\textit{COVID-19}_i - \textit{COVID-19}_i^{Staff} = \mu + \delta(FinVar_i) + \Gamma(\textit{Controls}_i) + \kappa_c + \upsilon_i \qquad (2)$$

Our estimate of interest is $\hat{\delta}$, which represents the differential sensitivity across residents and staff of COVID-19 to the financial variables of interest. A negative coefficient on *log(DaysCashOnHand)* and positive coefficient on (*MedicareShare*) would support the notion that facilities with stronger liquidity and cash flow positions were relatively more able to protect their residents from transmission.

Table 5, columns (1)-(3) present the results. When considering the nursing home's liquidity position, we find that those with greater days-cash-on-hand have a greater within-facility difference in the incidence of COVID-19. In other words, facilities with greater liquidity have a lower relative incidence of COVID-19 for residents compared to staff. The same is true for nursing homes that experienced a relatively smaller negative shock to their cash flows (smaller pre-pandemic *MedicareShare*). These regressions also account for possible differential sensitivities of resident and staff cases to the control variables used in our main tests. We also include county fixed effects to account for any local heterogeneity that might affect the differences, such as state- or county-level regulations or financial aid. In sum, after accounting for nursing-home-specific drivers of COVID-19 across residents and staff, those nursing homes with fewer financial resources to devote to risk mitigation ended up with significantly higher relative rates of COVID-19 in their residents.

We next construct a dependent variable to measure within-facility transmission. To the extent personal protective equipment such as N95 masks, gowns, gloves, etc. are purchased and used properly, there should be little scope for COVID-19 to transmit from staff to residents or vice versa, which we refer to as "cross-contamination." In our next test, we consider the sample of nursing homes where at least one staff member or one resident contracted

COVID-19, and we define an outcome variable *CrossContamination* equal to one if both groups ever experienced a new case within a four week rolling-window of one another. The variable equals zero when there is no such cross-contamination. Within this sample, where at least one group within the nursing home has a case, about 67% of nursing homes experience cross-contamination.

We estimate a regression of *CrossContamination* within a facility on our measures of cash and cash flow shocks to examine what roles these financial factors may play. Column (4) of Table 5 presents the results. We find lower *DaysCashOnHand* and higher pre-pandemic *MedicareShare* are related to the incidence of cross-contamination within a facility.

5.4 Financial Constraints, Shocks to Cash Flow, and COVID-19

In further considering the importance of financial factors for the spread of COVID-19, Hypothesis 3 predicts a stronger relationship between the measures of liquidity or cash flow shocks and the incidence of COVID-19 for smaller, more financially constrained nursing homes. Larger, less-constrained nursing homes are likely more financially equipped to undertake risk mitigation regardless of their internal liquidity or the size of their shock to cash flow. To test for a heterogenous relationship between *log(DaysCashOnHand)* or *MedicareShare* and COVID-19 incidence by firm size, we run the following regression:

$$\begin{aligned} y_i = \chi^{Liq}(Size_i \times log(DaysCashOnHand)_i) + \chi^{CashFlow}(Size_i \times MedicareShare_i) \\ +\beta(Size_i) + \lambda log(DaysCashOnHand)_i + \pi(MedicareShare_i) \\ +\Gamma(Controls_i) + \kappa_c + \upsilon_i, \end{aligned} \tag{3}$$

where y_i is one of our outcomes of interest ($COVID\text{-}19_i$, $COVID\text{-}19_i - COVID\text{-}19_i^{Staff}$, or $CrossContamination_i$), and *log(InpatientDays)* is our measure of size. If smaller, financially constrained nursing homes are more sensitive to financial factors, then we expect $\hat{\chi}^{Liq} > 0$

for our liquidity measure and $\hat{\chi}^{CashFlow} < 0$ for our measure of negative shocks to cash flow. These tests also help mitigate concerns that the financial factors are proxying for other baseline factors driving COVID-19 that differentially affect the incidence of COVID-19 or its relative transmission across residents and staff unrelated to nursing home finances.

Table 6 presents the results. We find statistically significant and economically meaningful estimates of the coefficients on the interaction terms with *log(DaysCashOnHand)*. We also see that the coefficients on the interaction between *MedicareShare* and size are negative and significant across all specifications. The results for suggest proportionately similar lower ex-ante liquidity or shocks to cash flows disproportionately impact nursing homes that are more likely to be financially constrained (smaller nursing homes). In sum, more-constrained facilities that have lower liquidity or experience more adverse cash flow shocks have a disproportionately higher likelihood of transmission of COVID-19 to their residents.

6 Conclusion

We provide evidence that firms with less internal cash and those experiencing more adverse cash flow shocks were least effective in protecting their customers from risk. Specifically, we find that nursing homes with less liquidity (days-cash-on-hand) to deploy for risk mitigation (e.g., PPE) at the onset of the pandemic were more likely to have COVID-19 cases. We also show that nursing homes hit with larger adverse shocks to cash flow – measured by larger pre-pandemic share of Medicare business, which dried up in response to elective surgery bans – experienced a higher incidence of COVID-19. We find similar results when examining within-facility differences in the incidence of COVID-19 among residents compared to staff and when examining cross-contamination between residents and staff more broadly. In tests that shed further light on the importance of financial factors in effective risk mitigation, we find these relationships are strongest for nursing homes that are most likely financially constrained.

Overall, our results highlight the challenges in risk mitigation that firms and other organizations face during the pandemic and the important role that liquidity and the ability to generate cash flow internally can play. These results shed new light on the propagation of COVID-19 and the important role that firms' financial circumstances have to play in their customers' lives. While our direct setting is the pandemic, our results suggest policymakers should take into account the link between financial strength and patient outcomes when considering issues including adjustments and overhauls of Medicare and Medicaid reimbursement schemes.

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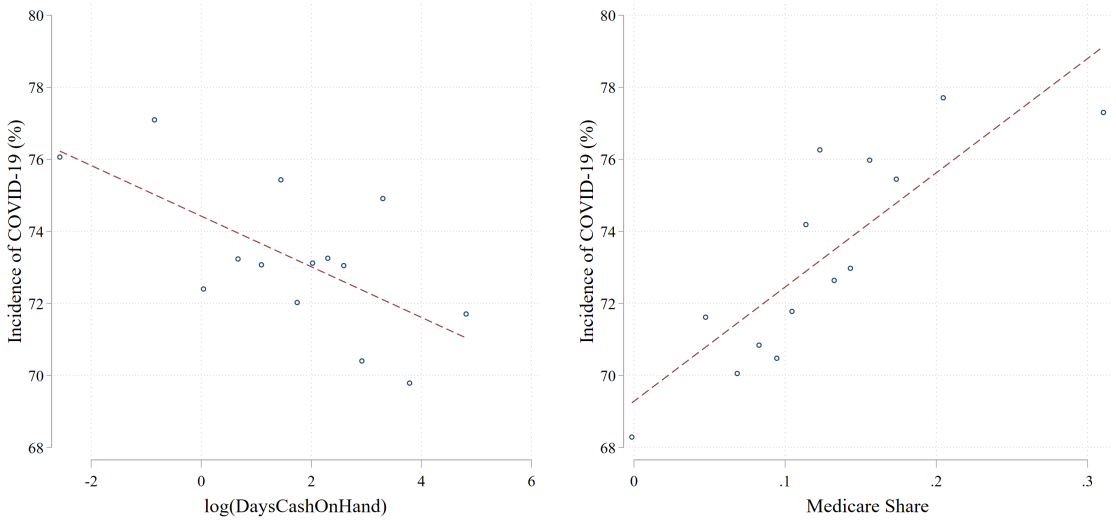

(a) log(Days Cash on Hand) **(b)** Medicare Share of Inpatient Days

Figure 1: Financial Factors and COVID-19 in Nursing Homes

This figure presents binned scatter plots of the likelihood a nursing-home has at least one COVID-19 case by October 18, 2020 as functions of the nursing home's *DaysCashOnHand* (number of days worth of operating expenses that can be covered by cash and equivalents) and *MedicareShare* (the share of overall patient days that are reimbursed through Medicare). Each plot controls for the nursing home's *log(InpatientDays)*, *log(Employees)*, *TotalMargin*, *Leverage*, *HealthInsp Rating* fixed effects as well as county fixed effects.

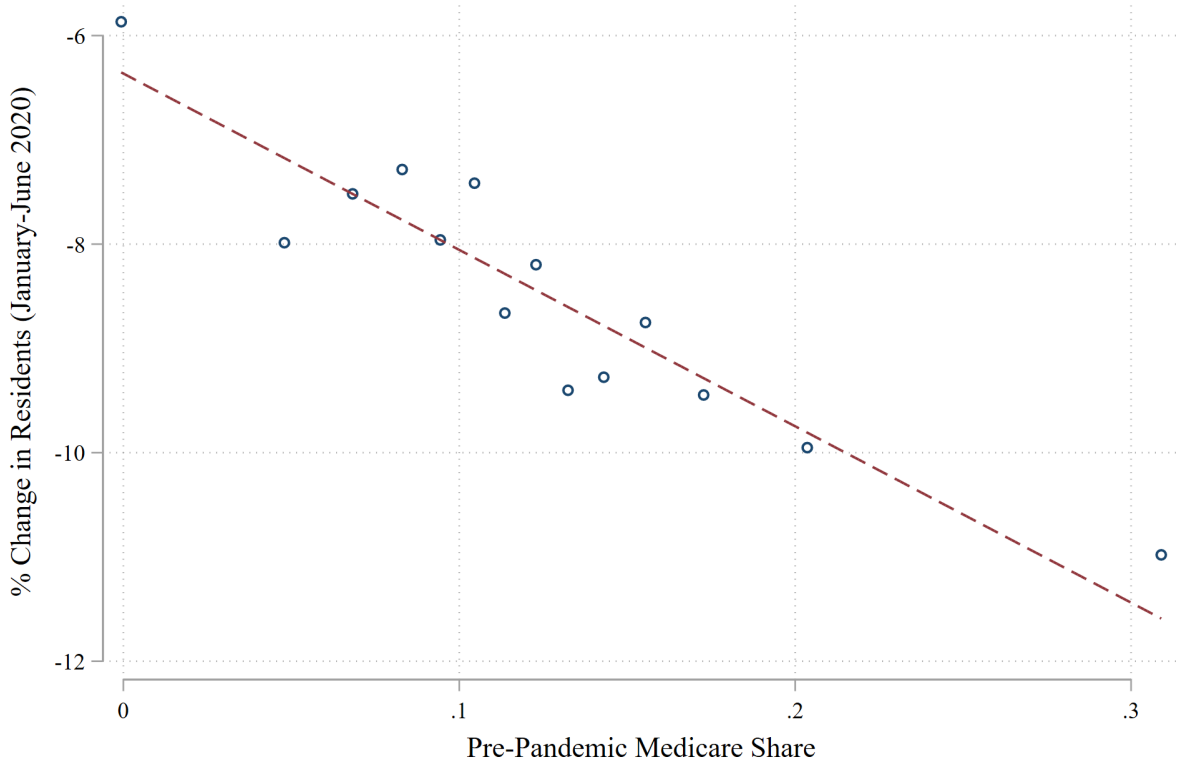

Figure 2: Medicare Share and Falling Occupancy
This figure presents a binned scatter plot of the percent change in nursing home residents from January to June 2020 as a function of the the nursing home's pre-pandemic share of overall patient days that are reimbursed through Medicare (*MedicareShare*). This binned scatter plot controls for the nursing home's *log(InpatientDays)*, *log(Employees)*, *TotalMargin*, *Leverage*, *HealthInsp Rating* fixed effects and county fixed effects.

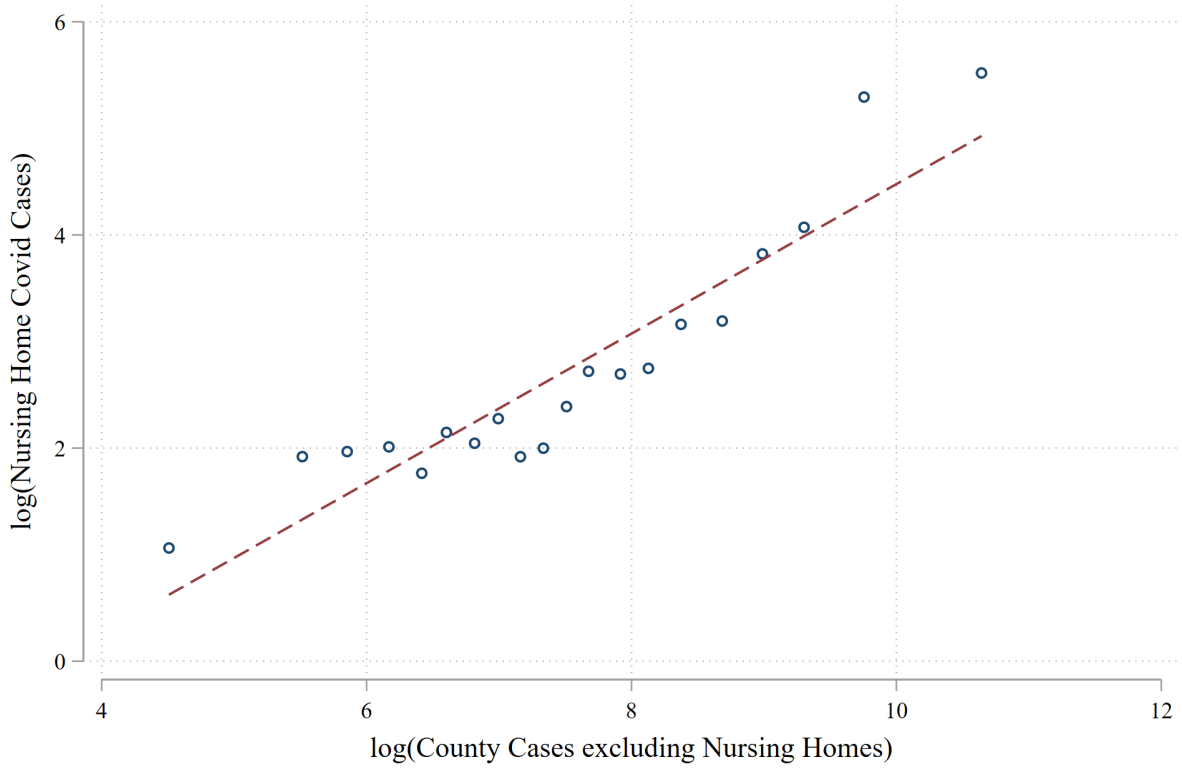

Figure 3: County COVID-19 Cases and COVID-19 in Nursing Homes
This figure presents a binned scatter plot of the log number of nursing home COVID-19 cases in a county as a function of the log number of non-nursing-home COVID-19 cases in that county through October 18, 2020.

Table 1: Summary Statistics

This table presents summary statistics for the variables used in our analysis. *COVID-19* is an indicator variable equal to one if the nursing home had at least one resident with COVID-19 as of October 18, 2020, while *COVID-19 cases* is the cumulative count of resident cases by that date. *COVID-19 death* and *COVID-19 deaths* are similarly defined using the presence and count of COVID-19 resident deaths. *COVID-19*$^{\text{Staff}}$ is an indicator variable equal to one if the nursing home had at least one staff member with COVID-19 by October 18, 2020. *CrossContamination* is an indicator variable equal to one if the nursing home had at least one resident and at least one staff member with COVID-19 within a four week rolling-window. *CountyCOVID-19 cases* is the number of COVID-19 cases reported in the county as of October 18, 2020 excluding those reported in nursing homes. *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, *%ChangeInResidents* is the percent change in resident population between January and June 2020, *InpatientDays* is the total number of days of service received by residents, *Employees* is the number of full-time-equivalent employees at the nursing home, *TotalMargin* is the net income divided by total revenue, *Leverage* is the net book leverage (net debt divided by total book capitalization), *Overall Rating* is the CMS "overall" rating from their five-star quality rating system, *HealthInsp Rating* is the component of the CMS rating program that comes from health inspections in which the top 10% in each state receive a top rating, *ZipMinorityShare* is the nonwhite share of the population in the five-digit zip code, *ZipHouseholdIncome* is the average household income in the five-digit zip code, *SqFt-per-Resident* is the square footage of the facility divided by the number of residents, and *AveUniqueVisitors* is the average number of unique visitors (using SafeGraph data) to the facility in the three months prior to the pandemic. Variables are winsorized at the 1% level to minimize the potential effects of outliers.

	mean	sd	p25	median	p75	n
COVID-19 Cases:						
COVID-19	0.73	0.44	0.00	1.00	1.00	7,347
COVID-19 cases	19.81	26.98	0.00	6.00	32.00	7,347
COVID-19 death	0.28	0.45	0.00	0.00	1.00	7,347
COVID-19 deaths	2.70	7.21	0.00	0.00	1.00	7,347
COVID-19$^{\text{Staff}}$	0.92	0.27	1.00	1.00	1.00	7,347
COVID-19 - COVID-19$^{\text{Staff}}$	-0.19	0.42	0.00	0.00	0.00	7,347
CrossContamination	0.67	0.47	0.00	1.00	1.00	6,766
County COVID-19 Cases (000s)	26.20	57.70	1.43	6.97	19.28	7,347
Nursing Home Characteristics:						
MedicareShare	0.13	0.10	0.06	0.10	0.16	7,347
DaysCashOnHand	24.00	35.41	1.22	8.78	30.50	7,347
%ChangeInResidents	-0.11	0.15	-0.19	-0.10	-0.02	7,312
InpatientDays (000s)	33.38	17.14	20.58	31.16	41.21	7,347
Employees	99.01	58.33	58.45	85.51	123.97	7,347
TotalMargin	0.00	0.09	-0.04	0.01	0.06	7,347
Leverage	0.76	0.70	0.27	0.66	1.02	7,347
Overall Rating	3.16	1.40	2.00	3.00	4.00	7,347
HealthInsp Rating	2.77	1.26	2.00	3.00	4.00	7,347
ZipMinorityShare	0.23	0.20	0.08	0.17	0.32	7,197
ZipHouseholdIncome (000s)	61.82	22.94	45.72	56.14	72.78	7,177
SqFt-per-Resident	270.85	168.65	161.62	220.87	327.71	7,227
AveUniqueVisitors	36.55	25.11	19.00	32.22	48.11	5,774

Table 2: Correlation of Nursing Home Characteristics

This table presents a correlation matrix for the nursing home characteristics used in our analysis. *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *InpatientDays* is the total number of days of service received by residents, *Employees* is the number of full-time-equivalent employees at the nursing home, *TotalMargin* is the net income divided by total revenue, *Leverage* is the net book leverage (net debt divided by total book capitalization), *Overall Rating* is the CMS "overall" rating from their five-star quality rating system, *HealthInsp Rating* is the component of the CMS rating program that comes from health inspections in which the top 10% in each state receive a top rating, *ZipMinorityShare* is the nonwhite share of the population in the five-digit zip code, *ZipHouseholdIncome* is the average household income in the five-digit zip code, *SqFt-per-Resident* is the square footage of the facility divided by the number of residents, and *AveUniqueVisitors* is the average number of unique visitors (using SafeGraph data) to the facility in the three months prior to the pandemic. Variables are winsorized at the 1% level to minimize the potential effects of outliers

	MedicareShare	DaysCashOnHand	InpatientDays	Employees	TotalMargin	Leverage	Overall Rating	HealthInsp Rating	ZipMinorityShare	ZipHouseholdIncome	SqFt-per-Resident	AveUniqueVisitors
MedicareShare	1.00											
DaysCashOnHand	0.02	1.00										
InpatientDays	-0.14	-0.06	1.00									
Employees	0.05	0.10	0.76	1.00								
TotalMargin	0.01	0.11	0.11	0.04	1.00							
Leverage	-0.01	-0.27	-0.07	-0.06	-0.41	1.00						
Overall Rating	0.21	0.17	-0.13	0.07	0.10	-0.13	1.00					
HealthInsp Rating	0.15	0.15	-0.15	-0.00	0.15	-0.14	0.86	1.00				
ZipMinorityShare	0.02	-0.02	0.26	0.17	0.07	-0.03	-0.09	-0.08	1.00			
ZipHouseholdIncome	0.18	0.02	0.05	0.12	-0.04	0.08	0.15	0.07	-0.19	1.00		
SqFt-per-Resident	0.09	0.19	-0.18	0.02	-0.14	0.04	0.14	0.09	-0.13	0.06	1.00	
AveUniqueVisitors	0.11	0.04	0.35	0.37	0.04	-0.02	0.05	0.03	0.14	-0.00	0.04	1.00

Table 3: Baseline Drivers of COVID-19

This table presents regression estimates of whether a nursing home had at least one COVID-19 case as of October 18, 2020 on the following variables: *CountyCovidCases* is the number of COVID-19 cases reported in the county as of October 18, 2020 excluding those reported in nursing homes, *InpatientDays* is the total number of days of service received by residents, *Employees* is the number of full-time-equivalent employees at the nursing home, *Overall Rating* is the CMS "overall" rating from their five-star quality rating system, and *HealthInsp Rating* is the component of the CMS rating program that comes from health inspections in which the top 10% in each state receive a top rating. Rating category 1 is the excluded category for the respective rating types. All estimations include county fixed effects except column (1), and all standard errors are clustered at the county level.

	(1)	(2)	(3)	(4)	(5)
log(CountyCovidCases)	0.080***				
	(<0.01)				
log(InpatientDays)			0.206***	0.191***	0.193***
			(<0.01)	(<0.01)	(<0.01)
log(Employees)			0.006	0.017	0.014
			(0.64)	(0.24)	(0.33)
Overall Rating=2				0.012	
				(0.47)	
Overall Rating=3				-0.003	
				(0.85)	
Overall Rating=4				-0.021	
				(0.30)	
Overall Rating=5				-0.036**	
				(0.05)	
HealthInsp Rating=2					-0.007
					(0.63)
HealthInsp Rating=3					-0.017
					(0.26)
HealthInsp Rating=4					-0.035**
					(0.03)
HealthInsp Rating=5					-0.049**
					(0.02)
Constant	0.043	0.733***	-1.413***	-1.291***	-1.298***
	(0.31)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
County FE	No	Yes	Yes	Yes	Yes
N	7329	7347	7347	7347	7347
R^2	0.111	0.366	0.405	0.406	0.405

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Financial Factors and COVID-19

This table presents regression estimates of whether a nursing home had at least one COVID-19 case as of October 18, 2020 on the following variables: *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, *InpatientDays* is the total number of days of service received by residents, *Employees* is the number of full-time-equivalent employees at the nursing home, *TotalMargin* is the (standardized) net income divided by total revenue, *Leverage* is the (standardized) net book leverage (net debt divided by total book capitalization), *ZipMinorityShare* is the nonwhite share of the population in the five-digit zip code, *ZipHouseholdIncome* is the average household income in the five-digit zip code, *SqFt-per-Resident* is the square footage of the facility divided by the number of residents, and *AveUniqueVisitors* is the average number of unique visitors (using SafeGraph data) to the facility in the three months prior to the pandemic. *HealthInsp Rating* fixed effects are not reported for brevity. *Case&Demographic Controls* include the average hierarchical condition category, share of patients with "very high" rehabilitation intensity, share of Medicare residents with stays less than 30 days, longer than 60 days, share of Medicare residents with stays less than 30 days, stays longer than 60 days, share using Medicare Advantage, and shares with asthma, congestive heart failure, COPD, and whether their primary condition for residency is congestive heart failure, COPD, infection, or injury. All estimations include county fixed effects, and all standard errors are clustered at the county level.

	(1)	(2)	(3)	(4)	(5)	(6)
log(DaysCashOnHand)	-0.007***		-0.006**	-0.006**	-0.008***	-0.007***
	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)
MedicareShare		0.317***	0.309***	0.316***	0.324***	0.269***
		(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
log(InpatientDays)	0.186***	0.225***	0.216***	0.215***	0.230***	0.179***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
log(Employees)	0.021	-0.004	0.004	0.005	-0.007	0.022
	(0.15)	(0.80)	(0.79)	(0.75)	(0.69)	(0.16)
zTotalMargin	-0.000	-0.002	-0.001	-0.001	0.000	-0.002
	(0.97)	(0.79)	(0.83)	(0.90)	(0.98)	(0.76)
zLeverage	-0.003	0.001	-0.002	-0.003	-0.004	-0.006
	(0.63)	(0.83)	(0.69)	(0.65)	(0.48)	(0.32)
ZipMinorityShare				0.097**		
				(0.01)		
log(ZipHouseholdIncome)				0.027		
				(0.23)		
zSqFt-per-Resident					0.009	
					(0.21)	
log(AveUniqueVisitors)					-0.002	
					(0.75)	
Case&Demographic Controls	No	No	No	No	No	Yes
HealthInsp Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
County Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7347	7347	7347	7152	5599	6217
R^2	0.406	0.408	0.409	0.408	0.422	0.424

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Within-Facility Tests

Columns (1)-(3) of the table present regression estimates of the difference in whether a nursing home had at least one COVID-19 case among residents ($COVID\text{-}19_i$) and at least one case among staff ($COVID\text{-}19_i^{Staff}$) as of October 18, 2020 on the following variables: *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, and the following control variables (omitted for brevity): *InpatientDays* is the total number of days of service received by residents, *Employees* is the number of full-time-equivalent employees at the nursing home, *TotalMargin* is the (standardized) net income divided by total revenue, *Leverage* is the (standardized) net book leverage (net debt divided by total book capitalization). The regression is specified in Equation 2. In column (4), the dependent variable, *CrossContamination*, equals one if both staff and residents have a COVID-19 case within a four week rolling-window and zero if only staff or only residents have cases. Nursing homes where neither group has cases are dropped from the regression in column (4). All estimations include county fixed effects and health inspection rating fixed effects, and all standard errors are clustered at the county level.

	$COVID\text{-}19_i - COVID\text{-}19_i^{Staff}$			CrossContamination
	(1)	(2)	(3)	(4)
log(DaysCashOnHand)	-0.006**		-0.005**	-0.005*
	(0.03)		(0.04)	(0.08)
MedicareShare		0.207***	0.200***	0.250***
		(<0.01)	(<0.01)	(<0.01)
Other Controls	Yes	Yes	Yes	Yes
HealthInsp Rating FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Observations	7347	7347	7347	6674
R^2	0.303	0.304	0.304	0.347

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Financial Constraints and COVID-19

Columns (1)-(3) of the table present regression estimates of whether there was at least one case of COVID-19 among nursing home residents ($COVID\text{-}19_i$) as of October 18, 2020 on the following variables: *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, *InpatientDays* is the total number of days of service received by residents (which is included separately, but not reported for brevity) and the following control variables (omitted for brevity), *Employees* is the number of full-time-equivalent employees at the nursing home, *TotalMargin* is the (standardized) net income divided by total revenue, *Leverage* is the (standardized) net book leverage (net debt divided by total book capitalization). In column (4), the dependent variable is the difference in whether a nursing home had at least one COVID-19 case among residents ($COVID\text{-}19_i$) and at least one case among staff ($COVID\text{-}19_i^{Staff}$) In column (5), the dependent variable *CrossContamination* equals one if both staff and residents have COVID-19 cases within a four week rolling window and zero if only staff or only residents have cases. Nursing homes where neither group has cases are dropped from the regression in column (5). All estimations include county fixed effects and health inspection rating fixed effects, and all standard errors are clustered at the county level.

	$COVID\text{-}19_i$			$COVID\text{-}19_i - COVID\text{-}19_i^{Staff}$	CrossContamination
	(1)	(2)	(3)	(4)	(5)
log(DaysCashOnHand)	-0.108**	-0.006**	-0.103**	-0.124***	-0.099**
	(0.02)	(0.02)	(0.03)	(0.01)	(0.04)
MedicareShare	0.297***	3.465***	3.387***	2.525***	2.932***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
log(DaysCashOnHand) × log(InpatientDays)	0.010**		0.009**	0.012***	0.009**
	(0.03)		(0.03)	(0.01)	(0.04)
MedicareShare × log(InpatientDays)		-0.316***	-0.309***	-0.234***	-0.267***
		(<0.01)	(<0.01)	(0.01)	(<0.01)
Other Controls	Yes	Yes	Yes	Yes	Yes
HealthInsp Rating FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Observations	7347	7347	7347	7347	6774
R^2	0.410	0.411	0.411	0.306	0.365

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A1: Robustness: Various Geographical Fixed Effects

This table presents regression estimates that link the financial variables of interest to the likelihood of a COVID-19 case at a nursing home using the ordinary least-squares setup in equation (1), while including different levels of geographical fixed effects. *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, *MedicareShare* is the share of overall patient days that are reimbursed through Medicare, and the control variables include *log(InpatientDays)*, *log(Employees)*, *TotalMargin*, *Leverage*, and *HealthInsp Rating* fixed effects. All estimations include fixed effects and cluster at the level indicated at the head of the column.

	(1) State FE	(2) CBSA×State FE	(3) City FE
log(DaysCashOnHand)	-0.008***	-0.008***	-0.006**
	(0.01)	(<0.01)	(0.04)
MedicareShare	0.458***	0.342***	0.259***
	(<0.01)	(<0.01)	(<0.01)
Other Controls	Yes	Yes	Yes
HealthInsp Rating FE	Yes	Yes	Yes
N	7347	7306	5027
R^2	0.198	0.297	0.481

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Alternative Measures of the Incidence of COVID-19

This table presents regression estimates using alternative measure of incidence of COVID-19 in nursing homes. The dependent variable in columns (1) and (2) is an indicator variable equal to one if a nursing home had at least one COVID-19 case and one COVID-19 death, respectively. Columns (3) and (4) use the inverse hyperbolic sine transformation ($\sinh^{-1}(y) = \ln(y + \sqrt{1 + y^2})$) of the total number of patient cases and total number of patient COVID-19 deaths, respectively. *DaysCashOnHand* is the number of days worth of operating expenses that can be covered by cash and equivalents, and *MedicareShare* is the share of overall patient days that are reimbursed through Medicare. All regressions include "Other Controls" for *InpatientDays*, *Employees*, *TotalMargin*, *Leverage*, and *HealthInsp Rating*. All estimations include county fixed effects, and all standard errors are clustered at the county level.

	$\mathbb{1}[y > 0]$		$\sinh^{-1}(y)$	
Measure of COVID-19:	Cases	Deaths	Cases	Deaths
	(1)	(2)	(3)	(4)
log(DaysCashOnHand)	-0.006**	-0.004*	-0.027***	-0.010
	(0.01)	(0.07)	(0.01)	(0.11)
MedicareShare	0.309***	0.185***	0.471*	0.340**
	(<0.01)	(<0.01)	(0.06)	(0.02)
Other Controls	Yes	Yes	Yes	Yes
HealthInsp Rating FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Observations	7347	7347	7347	7347
R^2	0.409	0.435	0.448	0.427

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A Details on Government Aid to Nursing Homes

Federal and state governments established or used several programs to help address the economic impacts of the COVID-19 pandemic. Skilled nursing facilities (nursing homes) qualified for a number of these programs. In the main text, we detailed the most relevant programs for our setting and analyses. Below we provide further details on two federal programs providing financial assistance to nursing homes.

A.1 Provider Relief Fund:

Through the CARES Act and the Paycheck Protection Program and Health Care Enhancement Act (PL 116-139), Congress made $175 billion available to healthcare providers. The U.S. Department of Health and Human Services distributed the money through the Provider Relief Fund. The skilled nursing facilities in our sample qualified for some of the disbursements made through this program. Like the Paycheck Protection Program (but unlike the Medicare Accelerated and Advanced Payment Program), the Provider Relief Fund payments did not need to be repaid.

The Provider Relief Fund provided money in stages to Medicare providers. The money was allocated based on gross patient revenues with payments equal to the minimum of 2% of the provider's gross patient revenue (the revenue source was not considered) or the sum of incurred losses for March and April 2020.[25] 2% of revenues is relatively small considering the average nursing home experienced a 11% decline in residents between January and June 2020.

[25]The timeline and calculations for the provider relief fund are provided by the HHS here: https://www.hhs.gov/coronavirus/cares-act-provider-relief-fund/general-information/index.html#eligibility. $30 billion was distributed between April 10-17 to over 300,000 Medicare Managed Fee-For-Service (MFFS) providers based on each provider's portion of the 2019 Medicare Fee-For-Service (MFFS) payments. On April 24, 2020, an additional $9.1 billion was provided to 15,000 MFFS providers based on revenues from CMS cost report data. Starting April 24, an additional $10.9 billion was made available to MFFS providers based on revenue submissions (only $2.4 billion was distributed as of June 15, 2020). On June 9, HHS expected to distribute approximately $15 billion to Medicaid providers that did not receive a payment from the initial allocation of the Provider Relief Fund, with the payment allocation equal to 2% of their revenues from patient care.

While nursing homes received some aid from these disbursements, nursing homes received less than 5% of the initial $30 billion (Goldfeder and Bedzow, 2020). The most direct form of aid for skilled nursing facilities came on May 22, 2020, two months after the onset of the pandemic. The Provider Relief Fund allocated $4.9 billion specifically to 13,000 skilled nursing facilities. The payment to each skilled nursing facility was based on the facility's number of certified beds. Specifically, each facility received: $50,000 plus $2,500 per certified bed. For example, a facility with 100 certified beds would receive $300,000.

The provider relief fund disbursements likely did not come quick enough or were not generous enough to mitigate the effects of the adverse cash flow shocks nursing homes experienced. The main disbursements to nursing homes on May 22, 2020 came over two months after the onset of the pandemic. The other disbursements were relatively small (at 2% of revenues) compared to the potential loss in revenues facing many nursing homes. The size of the disbursement was not related to our variables of interest (days-cash-on-hand and Medicare share) – especially after we control for home size – minimizing concerns that our results are capturing unobserved variation in government aid.

A.2 Paycheck Protection Program (PPP):

The PPP was established by the Coronavirus Aid, Relief, and Economic Security (CARES) ACT (PL 116-136) to help smaller businesses (fewer than 500 employees) cover their payroll costs in the initial months of the pandemic. Borrowers must certify in good faith that the "[c]urrent economic uncertainty makes this loan request necessary to support the ongoing operations of the Applicant." Eligible businesses can receive a maximum loan amount equal to 2.5 months of payroll costs (calculated based on 2019 tax filings). If the borrowing business uses the money according to certain rules (e.g., paying employees), then the cash infusion is considered a grant and does not need to be repaid. If not, then the loan must be repaid. As of January 2021, about one third of NAICS code 623100 firms, which includes nursing homes,

received a loan of at least $150,000 through the paycheck protection program.[26]

While the loans came relatively early, they may not have come quick enough or been large enough to mitigate the effects of the adverse cash flow shocks nursing homes experienced. There was still significant lobbying by the nursing home industry post-April for more government assistance suggesting PPP did not solve the economic woes facing nursing homes. In addition, the size of the loans was based on payroll, not the impact of the pandemic of nursing homes' cash flows and firm value. Nursing homes hit especially hard by the pandemic received similar-sized loans as homes that were not as impacted with similar payrolls. In other words, PPP did not address important cross-sectional heterogeneity in the size of the cash flow shock across nursing homes and, therefore, the effects of PPP are unlikely to be correlated with our cross-sectional variables of interest.

[26]Data are provided by the Small Business Administration for loans above $150,000.