Does Immigration Improve Quality of Care in Nursing Homes?*

Delia Furtado, University of Connecticut
Francesc Ortega, CUNY - Queens College

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Abstract. This paper explores how immigration can help mitigate nursing home staffing shortages, which are likely to worsen as baby boomers age. We show that local increases in immigration lead to fewer falls, less use of restraints, and fewer pressure ulcers among nursing home residents, as well as improvements in other measures of quality of care. Consistent with a labor market explanation, we find that immigration increases the local supply of workers in nursing fields, with the largest effect on the number of nurse aides – the workers primarily responsible for hands-on care in nursing homes.

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1. Introduction

Baby boomers are aging and fertility rates continue to decline. As a result, 4.7 percent of the U.S. population is expected to be above age 85 by the year 2060, a more than twofold increase from the corresponding share in 2016 (Vespa, Medina, and Armstrong 2020) and a tenfold increase from 1950 (Congressional Budget Office (CBO) 2013). In addition, according to the CBO (2013), about two thirds of individuals age 85 or above have a physical problem that makes it difficult to perform daily routine tasks such as eating, bathing, and dressing. While family members provide the majority of care for the elderly informally, about twenty percent of those requiring long-term care reside in nursing homes.[1]

Overall spending on nursing homes is increasing at a fast pace. In 2018, 168.5 billion dollars were spent on nursing care facilities and continuing care retirement communities in the United States, and over half of this was paid for by Medicare and Medicaid (National Health Expenditure Accounts (NHEA) 2019, Historical Files, Table 4). Prior to the COVID-19 pandemic, expenditures on nursing homes were expected to increase by an average of 5.7 percent each year between 2020 and 2027 (Sisko et al. 2019), and actual increases over this period are probably going to be substantially higher because of the pandemic. Given these trends, families and policy makers will either have to find additional sources of funding or limit the amount or quality of institutional care provided to the nation's elderly. In this context, it is important to examine whether immigration policy can be used to meet the rising demand for elderly care while reining in the cost. To this end, our paper examines the consequences of immigration on the quality of care in nursing homes.

Research shows that greater availability of nursing staff results in improved care in nursing homes. Stevens et al. (2015) argue that a major explanation for the declines in mortality rates among the elderly during bad economic times is that nursing homes are able to hire and keep better workers when unemployment rates are high. Supporting this idea, Huang and Bowblis (2019) show that higher unemployment rates are associated with fewer nursing home deficiency citations as well as

[1] Other estimates suggest that a 50-year-old has about a 50% chance of ever spending time in a nursing home (Hurd, Michaud, and Rohwedder 2014).

improvements in other measures of quality of care, including decreases in pressure sores and the use of physical restraints.

Papers directly linking the number of nurses working in nursing homes to quality of care provided in those nursing homes also suggest that nurses play an important role (Bostick et al. 2006; Leland et al. 2012). Much of this literature is rather correlational in nature. However, exploiting plausibly exogenous variation in the relative pay of nurses across England, Propper and Van Reenen (2010) show that lower (relative) nurse wages result in nurse understaffing in hospitals and increased hospital deaths from heart attacks. Foster and Lee (2015) show that Medicaid pass-through subsidies (which tied Medicaid reimbursements to staffing expenditures) were associated with both increased staffing and decreased pressure ulcers among nursing home residents. Relying on a very different source of variation, Gruber and Kleiner (2012) find that nurse strikes substantially increase within-hospital mortality rates for patients admitted during a strike, despite largely unchanged patient characteristics or treatment intensities. Exploiting yet a different source of variation, Friedrich and Hackmann (2021) show that nursing shortages induced by a maternity leave program in Denmark increased 30-day readmission rates among heart attack patients in hospitals and mortality rates in nursing homes.[2]

From a theoretical perspective, an inflow of immigrants into a local area may improve the quality of care provided by nursing homes for several reasons. First, if this increase in the supply of workers decreases wages in nursing occupations, nursing homes may respond by hiring more workers. If there are unfilled job openings, induced by minimum wage laws for example, then an inflow of immigrants to an area can help nursing homes fill these vacancies even if wages are unaffected. In both cases, immigration can improve the nurses-to-resident ratios. Well-staffed nursing homes can more readily respond to residents' needs. In addition, better-staffed nursing homes can adopt more labor-intensive practices considered best practice, such as reducing the use of restraints. Importantly,

[2] Besides the papers cited above, more detailed discussions of the nursing home industry along with the specific role of nurses can be found in Bostick et al. (2006), Cawley, Grabowski, and Hirth (2006), Harrington et al. (2020), Hirth et al. (2019), Iinattiniemi, Jokelainen, and Luukinen (2009) and Li et al. (2020).

immigration-induced increases in the supply of nurses (of all types) may arise from immigrants entering nursing professions themselves, or from natives who are displaced from other occupations, such as housekeeping or in-home elderly care (Peri and Sparber 2009; Butcher, Moran, and Watson 2022).

Even if the number of workers employed in nursing homes does not change, foreign-born workers may provide higher quality care to nursing home patients than native nurses. Using wages to measure quality, Cortés and Pan (2015a) show that Philippines-educated registered nurses (RNs) working in the U.S. tend to earn higher wages than observationally similar natives, potentially because of the strong positive selection into nursing in the Philippines, compounded by the likely positive selection involved in migrating to the United States. In another study, the same authors show that the equilibrium wages of RNs in fact do not respond to inflows of foreign-born nurses (Cortés and Pan 2014). However, in states with more foreign-born nurses, natives sitting for the nursing licensure exams tend to score higher marks (Cortés and Pan 2015b) pointing to an overall improvement in nurse effectiveness due to stiffer competition. It is possible that these findings extend to other, lower-educated types of nursing professions such as licensed practical nurses (LPNs) and nursing assistants/aides (NAs).[3]

Immigrants are overrepresented in health care professions. While constituting 15.5 percent of the U.S. population in 2017, 18.2 percent of healthcare workers were born abroad (Zallman et al. 2019). Immigrants are about equally as likely as natives to work as RNs and substantially more likely to work as NAs, though slightly less likely to be LPNs (Furtado and Ortega 2020). NAs have lower levels of educational attainment and are paid lower wages than LPNs and RNs. In 2019, NAs earned $14.25 per hour compared to $22.83 and $35.24 per hour for LPNs and RNs, respectively (Bureau of Labor Statistics 2020).[4]

[3] Throughout the paper, we use nurse assistants/aides (NAs) and certified nurse assistants (CNAs) interchangeably. The specific job titles used and credentials associated with them differ somewhat from state to state, but all have similar work responsibilities, especially among those employed in nursing homes.

[4] Registered nurses provide and coordinate patient care. They typically hold a bachelor's degree. Licensed practical nurses provide basic nursing care but often also have some supervisory responsibilities. For a license, they complete a state-approved training program, which typically takes about one year. Nursing assistants provide hands-on care. They need not have a high school degree but must complete a state-approved education program and pass a competency exam. For more details, see Bureau of Labor Statistics (2020).

Importantly, NAs are typically responsible for moving residents around nursing homes and helping them with daily-living activities, such as bathing, walking or getting dressed. In fact, they provide 80 percent of direct resident care (Castle and Anderson 2011). Ruffini (2020) shows that higher wages in nursing homes, induced by changes in minimum wages, lead to fewer violations, as well as fewer pressure ulcers and deaths among nursing home residents. She also presents evidence suggesting that these changes are driven by the labor supply decisions of NAs.[5] Using longitudinal data, Castle and Anderson (2011) show that increases in RN and NA staffing levels lead to improvements in a greater number of nursing home quality measures than do LPN staffing increases.

We contribute to this broad literature by explicitly linking immigrant inflows to a wide array of measures of the quality of care provided in nursing homes. Our nursing home data come from the Long-Term Care Focus (LTCFocus) data repository, which we match with Census and American Community Survey (ACS) data on immigrant inflows and other local area characteristics. We start by showing that an increase in the foreign-born population in an area (commuting zone) is associated with a local increase in the quality of care provided by nursing homes, as measured by a reduction in residents' falls, the use of restraints, and the number of residents with pressure ulcers.

Examining the relationship between *changes* in the immigrant population in a local area over time and *changes* in the local quality of care accounts for the fact that some cities on average attract more immigrants and have higher quality nursing homes than others. However, it remains possible that immigrants are choosing locations based on changes in economic conditions that may also affect the ability of nursing homes in those areas to improve care giving. To address this type of concern, we adopt an instrumental-variables approach and utilize two related instruments.

We start by providing two-stage least-square estimates (2SLS) that rely on the traditional shift-share instrument first introduced in Altonji and Card (1991) and further developed in Card (2001). The instrument uses data on pre-existing immigrant enclaves to predict the geographical location of

[5] In contrast, exploiting variation in minimum staff requirements across different U.S. states, Lin (2014) does not find any evidence that nursing assistants improve the quality of care in nursing homes but does find RN staffing has a large impact.

subsequent migrants (from the same countries of origin) across local areas. This instrument has come under scrutiny in recent years for a number of reasons. Chiefly, persistent local demand shocks may generate a correlation between the baseline immigrant shares used in the construction of the instrument and current labor demand shocks, violating the exclusion restriction.

To address this concern, we also use a new shift-share instrument introduced in Burchardi, Chaney, and Hassan (2019) and further developed in Buchardi et al. (2020). This instrument leverages "historical coincidences" (over more than a century) between the timing of large migrations from some origin countries (push factors) and the relative attractiveness of a particular local area at that time (pull factors) to *predict* plausibly exogenous distributions of immigrants across areas. In contrast, Card's instrument uses the *realized* pre-existing distribution of immigrants (in a fixed base year).

In particular, the Burchardi ancestry prediction relies on the fact that locations that happened to be thriving in (historical) years with large inflows of immigrants to the US from particular countries will have more individuals with an ancestral background from those countries even to this day. This implies that during our sample period, there will be larger increases in the number of immigrants in local areas with more people with the same ancestry as the immigrants coming to the U.S. today. For example, if during our sample period, newly arriving immigrants are predominantly from Mexico, China, India, and the Philippines, U.S. locations that were coincidentally booming in historical years (starting in the 1880s) during which there were large inflows to the U.S. from those countries will be predicted to have bigger changes to their immigrant population during our sample period than similar local areas that happened to be booming in years with coincidentally small inflows to the U.S. from these countries—but perhaps large inflows from other countries. While incorporating this basic intuition, the construction of the predicted ancestry distributions used to construct the new instrument also incorporates demanding sets of fixed effects and sophisticated leave-outs that purge a great deal of any potentially remaining endogenous variation.

Due to the similarities in the construction of the two instruments, one should expect generally similar estimation results. However, because of its design, the Burchardi et al. (2020) instrument requires weaker assumptions to be a valid instrument. Hence, if disparities arise in the context of a specific regression analysis, the estimates obtained with the Burchardi et al. (2020) instrument should be considered more reliable. As it turns out, in the context of our application, the results obtained using both instruments are generally very similar.

Our instrumental-variables estimates point to improvements in the quality of care provided by nursing homes in areas receiving more immigrants. Specifically, our preferred estimates imply that the typical 5-year change in the number of immigrants to a local area between 2005 and 2010--an increase of around 6,700 immigrants--led to reductions in the number of fallen residents, use of restraints and residents with pressure ulcers (in nursing homes in those areas) of 5%, 34% and 16%, respectively. The range in the size of the effects points to the different degree to which staffing improvements can improve each of the outcomes. Our estimates also suggest improvements along other dimensions, such as reductions in the number of residents experiencing declines in the ability to perform activities of daily living (ADLs) after entering the nursing home, declines in the number of residents experiencing daily pain, and decreased usage of catheters on residents.

Potentially complicating the interpretation of these estimates is the fact that when immigrants arrive at a new location, they not only work in nursing homes but also as home-care providers, allowing the elderly to delay entry into nursing homes. In this vein, Butcher et al. (2022) show that, in places with more immigrants, the US-born elderly are less likely to live in institutionalized settings. Motivated by this finding, our main specifications control for changes in the number of nursing home residents. In addition, we also examine the impact of immigrant inflows on the number of residents in nursing homes and find a small positive effect, possibly driven by the newly arriving foreign-born individuals that move into nursing homes. We also investigate if, by increasing the availability of home help, immigration introduces a selection effect that affects the average care needs of the new admissions to nursing homes, but do not find statistically significant effects.

Next, we examine the relationship between immigration and the local supply of nurse professionals as a potential mechanism driving our results.[6] Our estimates show that immigration

[6] We use the term "nurse professionals" to refer to registered nurses, licensed practical nurses and nurse assistants, combined.

increases the local supply of nurse professionals and the lion's share of this increase is driven by NAs, as one would expect given the overrepresentation of immigrants in this occupation. It is worth noting that the bulk of these increases are driven by greater availability of *foreign-born* NAs and to a lesser extent RNs, but we also find evidence of substantial *crowding-in* of natives into the NA occupation. Our interpretation is that recent immigrants displace natives away from informal employment (such as home help) and toward professions requiring more communication skills (Peri and Sparber 2009) and formal credentials.[7] In particular, some natives previously working informally as home care providers may have chosen to become NAs due to increased competition from recent immigrants. After all, low-skilled immigrants often work informally for private households (e.g. Cortés and Tessada 2011, Farré et al. 2011, Furtado 2016) and are not eligible to become NAs if they lack legal status.[8]

The remainder of the paper proceeds as follows. Section 2 is devoted to our data sources, and Section 3 describes our empirical strategy. Our main analysis of the effects of immigration on the quality of care in nursing homes is in Section 4. Section 5 explores increases in employment of nurses and nurse aides as a potential mechanism driving our results, looking both at the overall increases in nurse professionals (of each type) and at potential displacement of native nurses (of each type). Section 6 concludes.

2. Data and Descriptive Statistics

We rely on two main sources of data: the LTCFocus dataset, which provides data on nursing home outcomes and other characteristics, and the U.S. Census coupled with American Community Survey (ACS) data, which provides employment and demographic information. We retrieve county-level population data from the Census Bureau's Population Estimates Program, and the Buchardi et al. (2020) instrument from the webpage set up by the authors (https://www.immigrationshock.com). As we

[7] The BLS Occupational Outlook Handbook highlights communication skills as one of the four important qualities for nursing assistants (https://www.bls.gov/ooh/healthcare/nursing-assistants.htm#tab-4).
[8] Ortega and Hsin (2021) investigate the role of (explicit and implicit) occupational barriers in shaping the occupational choices of undocumented workers.

explain below, we aggregate the data from the different sources to the level of commuting zones, a commonly used definition of local labor markets.

Nursing Home Characteristics: LTCFocus

To measure nursing home characteristics, we rely on the LTCFocus dataset developed as part of the Shaping Long-Term Care in America Project at Brown University (LTCFocus 2021).[9] LTCFocus integrates data from the Online Survey Certification and Reporting System (OSCAR), which is collected during annual nursing home inspections by state survey agencies, Nursing Home Compare, which is collected by the Centers for Medicare and Medicaid Services (CMS), and the Minimum Data Set, an assessment of nursing home residents--both at entry and periodically after that--also collected by CMS. LTCFocus provides yearly information on nursing homes in the U.S. starting in the year 2000 but, because it combines multiple original data sources, we do not have information on every characteristic in each year. Moreover, there have been changes in the definitions of many variables from year 2011 onward, which leads us to conduct our analysis on the period 2000-2010.

We focus on three main measures of quality of care: the number of fallen residents over the previous 30 days (*Falls*), the number of residents that were restrained at the time of data collection (*Restrained*), and the number of (long-stay) residents with pressure ulcers (*PU*).[10] We chose to focus on these measures of nursing home quality because they crucially depend on the quantity and quality of nursing care.

The number of fallen residents over the last 30 days is a commonly used measure of quality of care in the literature because falls have been shown to trigger health deterioration and increased mortality (Kelly 2020; Rapp et al. 2008, 2009). Moreover, this measure appears to be particularly

[9] LTCFocus is sponsored by the National Institute on Aging (1P01AG027296) through a cooperative agreement with the Brown University School of Public Health.

[10] These and most other nursing home characteristics available in the LTCFocus data are provided in percentage form. For example, falls is measured by the proportion of nursing home residents present on the 1st Thursday in April who have fallen in the previous 30 days. We multiplied this figure by the number of nursing home residents on that day to calculate the number of fallen residents. We build the counts for the other outcomes analogously.

sensitive to the presence of nurse aides, an occupation in which immigrants are overrepresented. Nurse aides are responsible for assisting residents as they walk and go to the bathroom, when many falls occur. More generally, because nurse aides provide the bulk of direct care to residents, they are also especially likely to notice if residents are feeling anxious and nervous, which is considered a predictor of falls (Iinattiniemi et al. 2009). If nurse aides can themselves ease the anxiety of residents or at the very least, call attention to resident agitation, many falls may be prevented. Leland et al. (2012) report that residents in nursing homes with more NAs suffer fewer falls.

Understaffed nursing homes tend to make greater use of restraints such as vests, belts, mittens, wrist or ankle restraints, and chairs with locking tables.[11] In theory, restraints can prevent falls and other dangerous activities among agitated residents with only minimal use of nursing labor. In practice, however, they can have many harmful long-term consequences beyond producing substantial short-term discomfort among the residents. Residents who are restrained for extended periods tend to become weaker and can lose walking ability and the ability to function more generally. Attempts to escape the restraints often result in injury. In fact, although a major motivation for the use of restraints is to prevent falls, there is in general a positive relationship between restraint use and resident falls (Thomas et al. 2012, Hofmann and Hahn 2014). Restraint use is also associated with residents' lower cognitive performance, decreased abilities to perform ADLs, and higher walking dependence (Hofmann and Hahn 2014). Well-staffed nursing homes can address resident concerns before they become agitated, but they may also be able to keep residents safe through an agitation spell without requiring restraints. For the purposes of our research, another important reason to use the use of restraints as a measure of quality is that the number of residents that were restrained is *never* missing in our dataset. This will prove useful in assessing the impact of data censoring on our estimates.

[11] Cawley et al. (2006) show that when wages increase, nursing homes tend to substitute away from labor-intensive methods of care to materials-based methods, specifically the use of psychoactive drugs, associated with worse outcomes for residents. LTCFocus does not include data on psychoactive drugs, a type of pharmacological restraint.

One of the outcome measures most closely tied to nursing staff, and in particular nursing assistants, is the number of residents experiencing pressure ulcers (Horn et al. 2005). Bed-ridden residents are significantly more likely to develop pressure ulcers, but frequently turning and repositioning residents and applying ointment can decrease the incidence and severity of pressure ulcers. Moreover, residents of nursing homes with enough staffing to keep residents mobile (while taking care to prevent falls) are less likely to become bid-ridden and so less susceptible to pressure ulcers to start.[12]

In addition to the previous outcomes, we also examine the number of residents who have experienced declines in their abilities to perform activities of daily living (ADLs) and the number of residents reporting daily pain.[13] The former measures the change in the number of long-term residents needing help with ADLs--such as dressing, eating, and toileting--compared to a prior assessment conducted in the nursing home. Because maintenance of abilities to perform these tasks depends on whether residents are out of bed and engaged in these activities, we expect staffing improvements to decrease the number of residents experiencing ADL declines. In regards to reported pain, nurse professionals can decrease pain among nursing home residents by providing pain medication as well as nonpharmacological treatments, such as ice or heat packs. In the context of nursing homes, physical and cognitive impairments often make it difficult for residents to report pain to the staff. Attentive staff are likely to perceive pain in residents even without clear reports of pain made by the residents (Takai et al. 2010) and adopt measures to prevent pain from escalating.

We also consider the number of residents suffering urinary tract infections (UTIs) and the use of catheters within nursing homes. Catheterization puts residents at much greater risk for UTIs (Nicolle 2014), and so we discuss them together. Similar to restraints, catheters are used more often in understaffed institutions because they are less labor-intensive than walking residents to the bathroom

[12] The prevalence of pressure ulcers among nursing home residents is one of the measures used by CMS to determine the number of stars given to the nursing home in its Five-Star Quality rating system.
[13] The Five-Star Quality rating system uses many other measures of quality, but the three included in the LTCFocus dataset are pressure ulcers, ADL declines, and reports of daily pain. These variables are only available starting in 2006.

or using diapers. The catheters themselves are also less expensive than diapers. In interpreting any differential effects of immigration on these outcomes, it is important to keep in mind prior research showing that catheter use and UTIs tend to be more closely associated with RN hours while NA hours are important mostly for decreasing pressure ulcers (Horn et al. 2005; Konetzka, Stearns, and Park 2008). This may be because RNs are responsible for catheter placement and removal. UTIs (conditional on catheter use) can be minimized with proper hydration and good hygiene, primarily the responsibility of NAs but with RN supervision (Konetzka et al. 2008).

The LTCFocus dataset also contains additional nursing home characteristics that we will use as controls in our analysis. The most important is an acuity index, which measures the care needed by nursing home residents. It is calculated based on the number of residents needing various levels of assistance with activities of daily living and the number of residents receiving special treatments. The data also contain information on whether nursing homes are for-profit, part of a chain, or affiliated with a hospital. We also use data on the total number of beds along with the share of occupied beds to determine the number of nursing home residents. Last, we make use of the total number of beds in each nursing home to compute market shares to measure concentration in local nursing home markets, a variable we use in the last section of the paper.

The LTCFocus data are made available to researchers at different levels of aggregation: state, county and individual nursing homes. Other things equal, data at the nursing home level allow for more detailed analysis. However, due to confidentiality concerns, these data are heavily censored. Specifically, data cells are suppressed whenever they refer to a nursing home with fewer than 10 nursing home residents or with fewer than 10 instances of falls (or restraints, pressure ulcers, etc.). Since the same threshold of ten is used regardless of the level of aggregation, this practice affects more severely the dataset where the units of observation are individual nursing homes and is less pronounced in the more aggregated versions of the data (such as county or state). For this reason, we use the county-level version of the LTCFocus data and aggregate it to commuting zones (using the crosswalk provided in

Autor and Dorn 2013).[14] In the process, we impute zero values for the missing county-year observations. Given that practically all counties have more than 10 nursing home residents, this imputation is fairly accurate because we know that the true (missing) value entailed fewer than 10 residents experiencing that particular outcome (e.g. fallen residents).[15]

Table 1 provides some basic descriptive statistics on the commuting zone aggregates for the measures of quality of care used in the analysis. In year 2000, the number of fallen residents in the average commuting zone was 270 monthly, ranging between 0 and 5,190. The average number of falls in 2005 was slightly lower at 248 monthly but increased again in 2010, reaching 257. Among our three main outcomes, *Falls* occur most often. Turning now to the number of restrained residents, we observe a clear downward trend for the average value: 209 in year 2000, 142 in 2005 and 61 in 2010. This may reflect a growing consensus in the industry that restraints are harmful to residents. As for pressure ulcers, the data is not available for the year 2000. For years 2005 (using 2006 values) and 2010, the numbers of residents with pressure ulcers in the average commuting zone were 47 and 40, respectively.

Employment and Immigration: ACS and Census

Our data on immigration, employment, and other local area demographic characteristics are obtained from the 2000 U.S. Decennial Census and the 2005 and 2010 American Community Surveys (ACS). Up until the year 2000, the U.S. Census collected information on individuals' countries of birth, age, race, and employment along with many other characteristics in its long-form survey. Starting in the

[14] The analysis in Furtado and Ortega (2020) is based on the LTCFocus data at the level of individual nursing homes. The more disaggregated data allows for the estimation of models that better account for heterogeneity. However, as discussed above, the issue of data censoring is more severe. Another difference is that Furtado and Ortega (2020) analyze data that goes beyond 2010 and standardize the variables in order to smooth out the discontinuity arising from the changes in variable definitions from 2011 onward. Here we make a more conservative choice and restrict the analysis to years 2000-2010.

[15] The nursing home quality measures are provided in LTCFocus as the share of residents experiencing certain outcomes (falls, pressure ulcers, etc.). We converted these shares to the corresponding number of residents experiencing these outcomes by multiplying the shares by the number of nursing home residents. We focus our analysis on numbers rather than shares because the censoring rule implies that we can more accurately impute numbers. To fix ideas, consider a county with 15 nursing home residents with a missing value for the share of fallen residents. Given the censoring rule, we know that the true number of fallen residents ranges from 0 to 10, but the share of fallen residents ranges from 0 to 67%.

year 2000, the long form of the Census was replaced with the American Community Survey, which (since 2005) asks 1% of the U.S. population the same (or very similar) sets of questions each year. We use data from the 1970 Census (in particular, we merge the two metro samples in that year) as the baseline for the construction of the Card instrument. We use data from the 2000 Census for our measures of immigration and labor markets in that year. For the years 2005 and 2010, we build the analogous variables using the American Community Surveys. All of these data were downloaded from the Integrated Public Use Microdata Surveys (IPUMS) (Ruggles et al. 2018).

Assigning commuting zones to the individual-level data in the Census and ACS is complicated because the smallest levels of aggregation in these datasets--county group or Public Use Microdata Areas (PUMAs), depending on the year--often span multiple commuting zones. To address this issue, we use the crosswalk and probabilistic weighting technique developed by Autor and Dorn (2013) to aggregate the data to 1990 commuting zones. In this manner, we are able to construct measures of immigration, employment, and other demographic characteristics for all of the commuting zones represented in the LTCFocus data, and so merging the data sets by year and commuting zone is straightforward. We focus on the commuting zones in the continental United States.

As can be seen in **Table 1**, the foreign-born population in the average commuting zone in our data was approximately 48,000 individuals in year 2000 but grew to almost 62,000 in 2010. Our measure of immigration flows is simply the 5-year difference in the foreign-born population (DFB). The change in the foreign-born population for the average commuting zone was around 6,600 individuals between 2000 and 2005 and around 6,700 individuals between 2005 and 2010. Not surprisingly, there is wide variation in the size of immigration flows across commuting zones. For instance, in the 2005-2010 period, while one commuting zone lost almost 35,000 foreign-born individuals, another gained almost 217,000.

Table 2 provides descriptive statistics summarizing the employment of nurse professionals, of different skill types, across years and commuting zones.[16] In the year 2000, the average commuting zone had 7,223 nurse professionals (pooling 3,323 RNs, 877 LPNs and 3,023 NAs). About 20% of all nurse professionals in the average commuting zone (i.e. 1,470 nurses) worked in nursing homes and the rest worked in other workplaces, such as hospitals, schools and pharmacies. Interestingly, while NAs accounted for 42% of all nurse professionals, they comprise 63% of nursing staff in nursing homes, indicating that nurse aides' labor is intensively used in nursing homes.

It is also interesting to compare the trends between years 2000 and 2010. According to the data in the table, there has been a 32-percent increase in the number of nurse professionals over the decade, pooling all types of nurses. However, the growth has varied substantially across skill types. We observe a 6-percent increase in LPNs, a 21-percent increase in RNs, and a 52-percent in the number of NAs. Thus, the healthcare system overall is increasingly reliant on nurse aides. Not surprisingly, the number of nurse professionals is also increasing in nursing homes, with an 18-percent increase over the decade. Once again, NAs is the group with more pronounced growth (23% compared to 8-9% among RNs and LPNs).

Other Data Sources

To construct commuting zone populations, we use the NBER's Census U.S. Intercensal County Population Data, which are constructed by the Census Bureau's Population Estimates Program.[17] The Census Bureau's estimates use vital statistics data (on births, deaths and migration) to calculate the intercensal estimates at a yearly frequency. In the Census years, these estimates exactly coincide with the corresponding Census figure. The annual county population estimates from NBER are a slightly

[16] Technically, nurse assistants are not nurses (they assist nurses in performing nursing tasks), but we use the generic term "nurse" to refer to RNs, LPNs, and NAs together.
[17] These can be downloaded at https://www.nber.org/research/data/us-intercensal-population-county-and-state-1970.

improved version of the Census Bureau's population estimates in that the NBER provides a consistent dataset that extends over a long time period (1970-2014).

As discussed previously, we download the data used to construct the Buchardi et al. (2020) instrumental variable directly from their webpage. They construct the variable using data downloaded from the Integrated Public Use Microdata Series (IPUMS) samples of the 1880, 1900, 1910, 1920, 1930, 1970, 1980, 1990, and 2000 waves of the Census as well as the 2006-2010 five-year sample of the American Community Survey.

3. Empirical Strategy

Let us now describe our strategy to estimate the effects of immigration into a local area on the quality of care provided by nursing homes in that area. In our empirical analysis, we will focus on commuting zones as our geographical unit, which cover the entire United States and are meant to approximate local labor economies. However, when explaining our empirical strategy, we use the terms cities, local areas, and commuting zones interchangeably.

To fix ideas, consider a city experiencing an inflow of immigrants. Some of these incoming immigrants will seek jobs in nursing occupations within nursing homes. By increasing the local supply of nurse professionals (of all types, including nursing assistants), immigration may help mitigate understaffing problems and improve the quality of care in nursing homes. If foreign-born nurses and nurse assistants are particularly skilled at attending to nursing home residents, then improved nursing quality is another channel through which immigrant inflows may increase nursing home care quality.

Presumably, foreign-born nurses and nurse assistants will drive most of the overall changes in the quality of nursing home care driven by immigrant inflows. However, it is also possible that immigrants displace natives from other occupations and these displaced natives take nursing jobs in nursing homes. After all, most of the incoming immigrants will find jobs in other industries, including a wide range of household services. Low-education immigrants, in particular, may displace natives from informal employment providing household services and induce them to obtain the credentials necessary to apply for formal employment in nursing homes. We start our analysis by considering the overall impact of immigrant inflows on quality of care provided in nursing homes without differentiating between mechanisms.

We measure immigration flows into a commuting zone *c* by the change in the foreign-born population between two time periods ($\Delta FB_{c,t}$). Our measure of immigration flows includes individuals of all ages, genders and skill levels. As a result, only a small fraction of the immigrant flow will be employed in nursing occupations (and an even smaller fraction will work as nurses in nursing homes). In addition, some foreign-born individuals may be older and may themselves move into nursing homes in the city.

Specification

Our focus is on the overall effects of immigration on the quality of care provided by nursing homes at the commuting zone level. We consider commuting zone-level measures of quality of care ($y_{c,t}$), such as the number of nursing home residents experiencing falls in commuting zone *c* in year *t*. Clearly, the elderly population and the nursing homes will differ across commuting zones along many dimensions, some of which are hard to measure. If immigrants are attracted to larger, richer cities and these types of cities also have higher quality nursing homes, then we might erroneously attribute to immigrants what is actually caused by other factors. To mitigate this issue, we follow Burchardi et al. (2020) in using a first-differences specification so that we focus on the effects of immigration flows ($\Delta FB_{c,t}$) on the *change* in quality of care in the city's nursing homes ($\Delta y_{c,t}$). Specifically, we postulate that

$$\Delta y_{c,t} = \alpha_{s,t} + \beta \Delta FB_{c,t} + \delta \Delta R_{c,t} + \gamma X_{c,t-1} + u_{c,t} \qquad (1)$$

where the change in quality of care in city *c* between years *t-1* and *t* (t-1 refers to the period five years before t) is determined by the change in the foreign-born population over that same period, $\Delta FB_{c,t}$, the change in the number of nursing home residents over that period, $\Delta R_{c,t}$, state-year fixed effects, $\alpha_{s,t}$, a vector of start-of-(five-year) period controls, $X_{c,t-1}$, and a mean-zero disturbance term, $u_{c,t}$.

Conservatively, we choose to cluster standard errors at the state level, which allows for unrestricted correlation among commuting zones within a state and across time.

Our dependent variable is measured in changes, implying that the state-year fixed effects capture any (time-varying) factors that may have affected the *changes* in care quality equally across all commuting zones within each state. These factors could be demographic, related to the evolution of the economy in the state, or changes in technology or regulation affecting nursing homes and their residents. They will also pick up any nation-wide changes in the quality of nursing homes over time driven by federal laws or changing compositions of residents. The model includes lagged controls that vary across commuting zones and over time ($X_{c,t-1}$). Since we use five-year changes, the $X_{c,t-1}$ corresponding with changes between 2000 and 2005, for example, will refer to the values of X in the year 2000. Importantly, the vector includes population (in logs), which accounts for the disparities in the (population) size of commuting zones within a state and over time. The vector also includes commuting zone-level (start-of-period) control variables such as median wages, the proportion of the population age 65 or higher, and the proportion of individuals self-identifying as black. It also includes nursing home specific characteristics such as the average acuity of nursing home residents, the proportion of nursing homes that are for-profit, the proportion that are multifacility, and the proportion that are hospital-based.[18] Our most important control variable is the acuity index, which measures the average nursing needs of the nursing home's residents based on the number of residents needing different amounts of help with activities of daily living, the number of residents receiving special treatments such as respiratory therapy or intravenous treatments, and the number of residents with diagnoses requiring more intense care such as dementia. This control variable addresses concerns regarding selection into nursing homes in areas with larger immigrant inflows (as described in Butcher et al. 2022).

[18] These nursing home controls are commonly used in the nursing home literature (e.g. Cawley et al. 2006).

We also control for the change in the number of nursing home residents in the city, $\Delta R_{c,t}$, which accounts for any incoming foreign-born nursing home residents, but also any changes in the number of native-born choosing to live in nursing homes in response to immigration (as opposed to remaining in their homes) as argued in Butcher et al. (2022). Controlling for the change in nursing home residents is important because if immigrants lead to a *reduction* in the number of residents, then the number of 'bad events' (such as the number of residents who have fallen) will mechanically fall even without any improvements in the quality of care. Controlling for changes in the number of residents allows us to interpret changes in the number of residents' falls (and other outcomes) as evidence of quality of care changes. It also helps us to zero-in on the impacts of immigrant inflows operating through labor markets, our mechanism of interest, as opposed to changes in resident composition. However, adding this control comes at a cost since we are potentially introducing additional sources of endogeneity in the model. For this reason, we also report estimates of models that do not include any control variables.

Endogeneity of immigrants' location choices

It has long been recognized that immigrants' location choices are not random. As a result, cross-city correlations, even with first-difference models such as ours, are unlikely to uncover the causal effects of immigration due to endogeneity bias. After all, immigrants may be particularly attracted to areas with *growing* labor market opportunities and these areas may have improving (or worsening) nursing homes for reasons unrelated to the immigrants themselves. To address this concern, we start by following the instrumental-variables strategy most commonly used in the immigration literature (Altonji and Card 1991; Card 2001). The instrument has a shift-share structure where data on pre-existing immigrant enclaves at the commuting zone level are used to predict the geographical allocation of subsequent migrants (from the same countries of origin). More specifically, the *predicted change* in the foreign-born population in commuting zone *c* in year *t* is given by:

$$ZCard_{c,t} = \sum_o A_{o,c,1970} \Delta FB_{o,t} = \sum_o \frac{FB_{o,c,1970}}{FB_{o,1970}} \Delta FB_{o,t} \quad (2)$$

For each country of origin, *o*, the first term in the summation, $A_{o,c,1970}$, is commuting zone *c*'s share of all foreign-born individuals from that country of origin in baseline year 1970, and it is worth noting that these baseline immigrant shares are directly taken from the data (1970 Census).[19] The second term is a measure of the US-wide inflows of foreign-born individuals from origin country *o* between two time periods, *t* and 5 years before *t*. Adding up across all origins, the resulting $ZCard_{c,t}$ is the predicted change in the foreign-born population in commuting zone *c* between *t* and 5 years prior. The main identification assumption is that unobserved local demand shocks during the sample period, specifically those that affect nursing home quality, are uncorrelated with the determinants of the 1970 cross-commuting zone allocation of immigrants, an assumption that becomes more plausible as the baseline year is further removed from the estimation period. We must also assume that any 5-year change in nursing home quality *in a particular city* does not spur a contemporaneous nation-wide increase in the number of immigrants to the entire U.S. in that same time period.

It has been shown many times, both in applications using U.S. data as well as for other countries, that Card's instrument is a strong predictor of actual immigration flows. However, several researchers have documented that the predictive power of the instrument has fallen substantially since the 1990s (Card and Lewis 2007; Butcher et al. 2022), presumably because the location choices of recent U.S. immigrants have been less related to pre-existing enclaves than they used to be. Partly for this reason, researchers have experimented with variations in the construction of the instrument (e.g. Smith 2012; Shih 2017) or focused their analysis on earlier periods (e.g. Butcher et al. 2022).

In the last few years, a number of studies have also raised concerns about the potential endogeneity of the baseline immigrant shares at the core of Card's instrument.[20] Given our context, we

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[19] Following Basso and Peri (2015), we group detailed origin countries in the Census and ACS into 16 categories that are consistent across the years.

[20] Several recent studies analyze shift-share instruments in depth (Borusyak, Hull, and Jaravel 2022; Goldsmith-Pinkham, Sorkin, and Swift 2020; Adão, Kolesár, and Morales 2019). For a discussion of the identification assumptions behind shift-share instruments, see Goldsmith-Pinkham et al. (2020). In related work, Jaeger, Ruist, and Stuhler (2018) argue that serial correlation may lead to incorrect inference on the short-run economic effects of immigration. In their analysis of the effects of immigration on innovation and economic growth, Burchardi et al. (2020) carry out a number of tests that suggest their instrument is not affected by the critique in Jaeger et al. (2018) and does not correlate with persistent productivity shocks.

are concerned that factors that attract immigrants to a local area in 1970 may induce persistent changes in the quality of nursing homes from 2000 to 2005 or from 2005 to 2010 for reasons unrelated to new immigrant inflows to that area. For example, given that many immigrants work in the healthcare sector, the construction of a new teaching hospital in a city in 1970 may attract many immigrants to that city in that year. That same hospital and its affiliated medical school may also induce persistent improvements in the quality of care provided in hospitals and nursing homes decades into the future.

In response to these types of endogeneity concerns, we adopt a recent reincarnation of Card's instrument that is more plausibly exogenous. Just like Card (2001), we use an instrumental variable that relies on the tendency of immigrants to gravitate to places with established communities of people from their origin country, regardless of the vibrancy of the economy (or the health care sector) at the time of their move. However, the new instrument, developed in Burchardi et al. (2019, 2020), plausibly ensures that the establishment of these ethnic communities is not correlated with factors driving *future* improvements in the quality of care in nursing homes. Specifically, instead of constructing past local immigration shares on the basis of *realized* values (as in Card's instrument), Burchardi et al. (2019, 2020) build a shift-share instrument based on a *prediction* for an area's ancestral composition that relies exclusively on a large number of historical push-pull immigration episodes. Using an acronym based on the authors' names, we refer to this instrument as the BCHTT instrument.

The key insight here is that part of the reason for why immigrants from a particular origin country (and their offspring) end up overrepresented in a specific local area can be explained by the historical coincidence of which areas of the U.S. were booming in the years in which large numbers of immigrants from that particular origin country were arriving to the country. For instance, as argued in Buchardi et al. (2020), large numbers of Italians migrated to the U.S. around 1910 driven by political changes and economic hardship in Italy at that time. Meanwhile, the peak for U.S. migration from Eastern Europe and Russia was closer to 1920, following the October Revolution in 1917. Other home country-specific historical events or home country-specific U.S. immigration law changes can explain the timing of migration peaks from many different origin countries throughout the last century and even before that.

Meanwhile, there is also variation in the areas of the U.S. that were booming across time. In the mid-nineteenth century, most immigrants settled on the East Coast of the U.S., but by the end of the century, the Midwest had relatively more opportunities for newly arrived immigrants. The West was particularly attractive in the early 1900s, but with the proliferation of air-conditioning, the South grew more starting in the 1980s. This implies, that all else equal, immigrant groups arriving mostly in the early 1900s would be overrepresented in counties in the West while those arriving in the 1980s would be overrepresented in the South.

The interaction of the cross-time variation (throughout the past century) in the relative attractiveness of different U.S. destinations with the staggered arrival of immigrants from different countries can be used to predict the distribution of ancestries across the U.S. in more recent years. If all else equal, immigrants arriving in our sample period (2000-2010) prefer to settle in places with more co-ethnics, this variation in predicted ancestral distribution can then be used as a factor pulling new migrants from different countries to different U.S. locations for reasons unrelated to correlates of nursing home quality.

The BCHTT instrument adopts the shift-share structure of Card's instrument but uses predicted location decisions as opposed to realized values to measure "pull." It also focuses these predictions on non-Europeans instead of all immigrants. As can be seen in equation (3) below, the terms inside the summation on the right-hand side are the lagged (start-of-period) predicted local (non-European) ancestry shares, $\hat{A}^{NE}_{o,c,t-1}$ and the origin-specific inflows of immigrants (over the 5-year period) from non-European countries, $Im^{NE}_{o,t}$: [21]

[21] In order to focus on the key innovation of the BCHTT instrument over the Card instrument, equation (3) abstracts from some details of the new instrument. Further details on the construction of the BCHTT instrument are provided in **Appendix A**.

$$ZBCHTT_{c,t} = \sum_o \hat{A}^{NE}_{o,c,t-1} Im^{NE}_{o,t} \qquad (3)$$

The edge of the BCHTT instrument in terms of identification lies in the construction of the *predicted* ancestry shares, which are designed so that the BCHTT instrument requires a weaker exclusion restriction than Card's instrument.[22] ZBCHTT is a predicted number of non-European immigrants in local area *c* in year *t* based on variation over time in the relative attractiveness of different U.S. locations to Europeans. More specifically, the predicted ancestry terms are based *solely* on the cumulative effect (over more than a century) of the coincidence between origin-specific *push* factors with destination area *pull* forces, as denoted by

$$\hat{A}^{NE}_{o,c,t} = \sum_{\tau=1880}^{t} \left(I^{NE}_{o,-r(c),\tau} \widetilde{\frac{I_{Europe,c,\tau}}{I_{Europe,\tau}}} \right), \qquad (4)$$

where $I^{NE}_{o,-r(c),\tau}$ refers to the number of immigrants from (non-European) origin country *o* in all regions of the U.S., except the region in which county *c* is located, in Census-year τ. Similarly, $I_{Europe,\tau}$ refers to the number of European immigrants living across the entire U.S. in year τ, and $I_{Europe,c,\tau}$ denotes the number of European immigrants living in county *c* in year τ.[23]

The push-pull factors inside the parenthesis have several important features. First, they incorporate a clever use of leave-outs. For instance, Equation (4) makes use of the fact that, historically, most of the immigrants coming to the U.S. were European while the more recent immigrants (during the period of our analysis) are from other parts of the world. Equation (3) only sums across non-European origin countries, whereas the local pull factors in Equation (4) are measured on the basis of each location's historical attraction to European migrants. This addresses the concern, for example, that

[22] Another difference between equations (2) and (3) is that the baseline shares in ZCard are time-invariant and measured in 1970. In contrast, the shares in ZBCHTT vary over time and correspond to the previous period. While this could potentially be an important distinction, Burchardi et al. (2020) show that this is not the case (Table 4). They show that replacing the lag of predicted ancestry shares in equation (3) for predicted ancestry shares in 1975 (for all estimation years) makes virtually no difference in terms of instrument relevance and second-stage estimates. We chose the formulation in equation (3) to be consistent with the main analysis in Burchardi et al. (2020).

[23] The predicted ancestry terms are not shares, strictly speaking. The actual equation used to predict ancestry does some rescaling to match the scale of the immigration flows it is meant to predict (**Appendix A**). We abstract from this detail here for the sake of clarity.

Filipinos (often nurses) and Indians (often doctors) might be "pushed" to the U.S. in years, both historically and during our sample period, in which U.S. cities specializing in health care are thriving. By measuring the historical attractiveness of U.S. local areas based on location choices of Europeans, who have no particular link to the healthcare sector and who are not included in our prediction, we are minimizing this particular concern.

It is also noteworthy that when measuring the immigrant push factor to a local area, in the pre-sample-period years, immigrants from each origin country settling in that particular local area--actually, the entire region of the U.S. in which that local area is located--are not included. This modeling choice helps to rule out the possibility that a demand shock for healthcare workers in a particular city induces large enough inflows of immigrants to the entire United States.

The tilde over the push-pull terms in parenthesis indicates that these terms have been previously residualized of origin and year fixed effects (as well as bilateral controls). As described in detail in **Appendix A**, this residualization technique nets out variation arising from destinations that always attract more immigrants or from origin countries that always send many migrants to the U.S..[24] In essence, the main ancestries predicted to be prominent in a particular destination at a point in time will be *exclusively* determined by the set of countries that happened to send disproportionately large numbers of migrants to the United States in past periods when that destination happened to be particularly attractive to (European) migrants. Combining equations (3) and (4), the final expression for the predicted immigration flows becomes

$$ZBCHTT_{c,t} = \sum_o \left[\sum_{\tau=1880}^{t-1} \left(I_{o,-r(c),\tau}^{NE} \times \widetilde{\frac{I_{Europe,c,\tau}}{I_{Europe,\tau}}} \right)\right] Im_{o,t}^{NE} \quad . \tag{5}$$

Importantly, Burchardi et al. (2020) structurally estimate a dynamic, general equilibrium model with persistent local productivity shocks and endogenous migration from multiple origin countries. Using data simulated within their model, they show that Card-predicted immigration flows are correlated with

[24] As described in **Appendix A**, the model used to build the predicted ancestry terms contains origin country by destination Census region by year fixed effects, origin continent by destination by year fixed effects and bilateral distance between origin countries and local destinations (equation 2 in Burchardi et al. 2020).

current shocks to productivity and wages, which violates the instrument's exclusion restriction, but the BCHTT-predicted flows are not.

The original BCHTT instrument is constructed at the county level for 5-year intervals. For our analysis, we aggregate the county-level predicted immigration flows to commuting zones and focus on the period 2000-2010. Validity of the BCHTT instrument requires uncorrelatedness with the disturbance term in **Equation (1)**. Namely, local shocks to the quality of nursing homes after year 2000 are assumed to be uncorrelated with the residualized historical push-pull factors used to build the instrument. In other words, nursing homes with improvements in quality in our sample period are not systematically located in areas that, perhaps by coincidence, had historically been booming in years during which a large number of immigrants were coming to the US, specifically from those countries sending large numbers of immigrants to the U.S. today. This main intuition, as well as the leave-outs and residualization techniques described above, build a strong case for the BCHTT instrument being more plausibly exogenous than the traditional Card instrument.

First-stage regressions

Next, we evaluate the relevance of our instrumental variables. Formally, we use the following model to analyze the predictive power of our instruments:

$$\Delta FB_{c,t} = \alpha_{s,t} + \beta Z_{c,t} + \delta \Delta R_{c,t} + \gamma X_{c,t-1} + u_{c,t} \qquad (6)$$

where $Z_{c,t}$ denotes the predicted change in the foreign-born population in commuting zone *c* in the 5-year period ending in year *t*, either using Card's or BCHTT's instrument. The other variables are defined as they were in equation (1).

Table 3 reports the estimation results. In columns 1 and 2 we report the estimates for the BCHTT predicted-ancestry instrument. Regardless of the inclusion of the control variables, the estimated coefficients are highly significant with an associated F statistic of 26 (without controls) and 40 (with controls). Columns 3 and 4 report the estimates based on Card's instrument for the same time period. The point estimates are also highly significant and the associated F statistic ranges between 30 (no controls) and 27 (controls). In sum, both instruments are highly relevant predictors of 5-year changes in the foreign-born population at the level of commuting zones. Given their similar predictive power, our preferred estimates rely on the BCHTT instrument because it is more plausibly exogenous, but we report estimates using both instruments throughout our analysis.

Figure 1 presents visual representations of these conditional correlations through bin scatter plots. Clearly, there are strong positive associations between the actual and predicted values for the change in the foreign-born population (DFB) using both instruments. Moreover, even if the bins corresponding to the highest and lowest values were excluded, the positive association between actual and predicted values remains.

4. Immigration and Quality of Care in Nursing Homes

The goal of this section is to estimate the effects of immigration on the quality of care provided by nursing homes at the level of commuting zones. We consider several measures of quality of care but focus on three main outcomes: number of residents who have fallen (*Falls*), were restrained (*Restrained*), or had pressure ulcers (*PU*) over the last 30 days.

Main Outcomes

Before turning to formally estimating the effects of immigration on quality of care, let us examine graphically the correlations between changes in our main outcomes and immigration flows. **Figure 2** plots changes in each of our main outcomes with immigration flows, after partialling out the effect of population size. Clearly, there are pronounced negative associations between the changes in the number of falls, restrained residents, and pressure ulcers and the change in the foreign-born population at the commuting zone level. It stands out that one bin contains commuting zones with very large immigration flows and large reductions in all three outcomes. However, the figures also reveal that excluding the commuting zones in that bin still entails a strong negative correlation between the changes in the outcomes and immigration flows.

A number of confounding factors could drive the previous correlations. For example, even holding constant base-year population, commuting zones with larger immigrant inflows may be experiencing abnormally high economic growth, making it possible for people in those areas to afford higher quality nursing homes. This would result in aggregate quality of care improvements in the commuting zone, but immigration would not be the *cause* of those improvements. As discussed in the previous section, we mitigate this concern by estimating a model with state-specific trends and a comprehensive set of control variables (**Equation 1**). In particular, we control for the median wage in the commuting zone, which helps account for changes in the ability to pay for higher quality care. Additionally, we shall also adopt an instrumental-variables approach to exploit plausibly exogenous variation in immigration flows.

The estimates for our three main quality of care measures are reported in **Table 4**. Let us begin with the top panel of the table, which reports OLS estimates. Columns 1-3 report estimates of the specifications with the state-year fixed effects but without control variables. The point estimates are negative for the three outcomes, indicating that immigration flows at a local level are associated with *reductions* in falls, the use of restraints and pressure ulcers. In other words, the estimates suggest that immigration leads to *improvements* in quality of care in commuting zones that received larger immigration flows. Adding our control variables to the model (Columns 4-6) confirms the previous findings. Note also that, for the three outcomes, we can reject the zero null hypotheses at the 5 percent (or lower) significance levels.

It is also worth noting that the results are *qualitatively* the same for our three main measures of care quality. This is reassuring for two reasons. First, since all of these outcomes are likely to be affected by the availability and quality of nursing home staffing, it would be suspicious if only one measure of care quality improved in response to immigrant inflows. Another reason why it is reassuring to find effects that go in the same direction has to do with the data censoring problem discussed earlier.

Specifically, recall that the *Restrained* outcome does not suffer from censoring, whereas the data for the other two main outcomes is censored to some degree. Estimating negative coefficients for the three outcomes makes us more confident in concluding that the results are not driven by censoring bias.

Clearly, if immigrants disproportionately move to commuting zones where the quality of nursing homes is *changing* for unobserved reasons, the previous OLS estimates will not identify the causal impact of immigration. In fact, the general presumption is that immigrants disproportionately choose to locate in areas with booming labor markets. Based on the findings in Stevens et al. (2015) and Huang and Bowblis (2019), we could expect *declines* in the quality of nursing homes (i.e. increases in falls, use of restraints and pressure ulcers) in those areas because of better job prospects outside of nursing homes. Thus, we expect OLS estimates of the effects of immigration on *Falls* (and our other outcomes) to be *upwardly* biased due to the spurious positive association between our outcome variables and immigration flows arising from local economic shocks.

Let us now turn to the 2SLS estimates, which account for the potential endogeneity of migrants' location decisions. The middle panel of **Table 4** presents our preferred estimates, based on the more plausibly exogenous BCHTT instrument. Both with and without controls, the point estimates are again negative and highly statistically significant. In comparison to the OLS estimates, the point estimates are now larger in absolute value, implying that OLS estimates were *upwardly* biased, as expected on the basis of the discussion above. The same is true when we consider the 2SLS estimates based on Card's instrument (bottom panel), which produces very similar point estimates overall to those obtained with the BCHTT instrument.[25]

Let us now examine the magnitude of the effects of immigration implied by our estimates. On the basis of the 2SLS estimates with the BCHTT instrument (in the specification with controls), the

[25] The first stage for the Card instrument (with controls) is slightly weaker than for BCHTT's instrument for residents' falls and the use of restraints (F statistic of 27 versus a value of 40 for BCHTT). The first stage for Card's instrument is much stronger for the pressure ulcer outcome, where we use only one first difference outcome (F statistic of 38 versus approximately 6 for BCHTT). However, because the BCHTT IV is more plausibly exogenous, we are concerned that some of the predictive power of Card's instrument for this outcome may rely on variation that is less credibly exogenous.

arrival of 1,000 immigrants to a commuting zone lowers the number of fallen residents by 1.9, the number of restrained residents by 7.1, and the number of residents with pressure ulcers by 1.1. The average commuting zone in 2005 had 247.5 fallen nursing home residents, 142.0 restrained residents, 46.5 residents with pressure ulcers, and went on to receive a 6,700 increase in the number of immigrants between 2005 and 2010 (see **Table 1**). Our estimates imply then that the typical immigration inflow to a local area led to reductions in the number of fallen residents, use of restraints and residents with pressure ulcers (in nursing homes) of about 5%, 34% and 16%, respectively. The range in the size of the effects may point to the different degrees to which staffing improvements are able to improve each of the outcomes. These estimates suggest that immigrant-induced mitigation of staffing problems helps improve quality of care. To assess the plausibility of these estimates, while at the same time considering mechanisms, it is useful to consider what fraction of a given flow of immigrants become nurses, particularly in nursing homes. We come back to this discussion in **Section 5** where we analyze the effects of immigration on the local supply of nurses.

Other Outcomes

Table 5 reports our estimates for several other quality of care indicators in nursing homes. Specifically, we consider the number of residents that experienced ADL decline over the last month, the number with long-term pain, the number of residents with urinary-tract infections (UTIs), and the number using catheters. As was the case with pressure ulcers, the number of residents experiencing declines in their abilities to perform ADLs and the number of residents experiencing pain originate from the Nursing Home Compare data and, as a result, we only have one cross-section of changes in these variables (for 2005-2010).

Our preferred estimates are reported in the middle panel (model with controls and BCHTT instrument). The point estimates are all negative and statistically significant (at a 5 or 10 percent level) except for UTIs, suggesting that infections may be less sensitive to understaffing problems than the other outcomes. The analogous estimates for pain and the use of catheters based on Card's instrument are quantitatively very similar to the ones obtained using the BCHTT instrument, providing additional support for reductions in these outcomes due to immigration. That said, except for the pain outcome, the Card 2SLS estimates do not allow us to reject the zero null hypotheses. All in all, however, our analysis of these additional quality of care indicators provides further confirmation that immigration improves quality of care in nursing homes, particularly in regards to pain reduction.

Immigration and the Demand for Nursing Homes

Elderly individuals needing assistance have several options. Besides moving to a nursing home (or some other assisted-living facility), they can also choose to move in with their children, or remain in their homes and hire someone to provide the help they need.

Over the last decade, several studies have shown that immigration increases the supply of workers providing a wide range of household services, including cooking, cleaning, childcare and elderly care. Cortés and Tessada (2011) show that low-skilled immigration allowed highly skilled women in the United States to reduce their time spent in housekeeping and increase their labor supply. Using data for Spain, Farré et al. (2011) present similar findings and provide additional evidence for the link between low-skilled immigration and the availability of workers providing household services. Focusing on immigration's effects on childcare markets, Furtado (2016) shows that college-educated women have more children when there is more immigrant labor available to provide childcare services.[26]

More recently, Butcher et al. (2022) and Mockus (2021) show that in areas with a more abundant low-education immigrant population, US-born elderly are *less* likely to live in institutions (i.e. nursing homes). They argue that this is because these immigrants lower the cost of the services required by the elderly to remain in their homes.[27] If immigrant inflows enable the more able elderly to

[26] These are only examples of papers linking immigrant inflows to women's work and fertility decisions via household service markets. For a more comprehensive review, see Furtado (2015).
[27] Escarce and Rocco (2018) find evidence of a positive effect of immigration on the physical and mental health of the elderly population in Western Europe. They show that in places with more immigration, the elderly are more likely to maintain social connections. One could argue that this is partly because the immigrant-induced improved ability to outsource housekeeping, cooking, and other care services allows the elderly to remain out of nursing homes.

remain in their homes, we may observe only the higher-needs individuals (i.e. those at highest risk for falls and other bad outcomes) entering nursing homes. At the same time, our previous estimates show that immigration also improves the quality of care in nursing homes, probably making them more attractive to the elderly population (and possibly reducing the cost as well). This implies that some people at the margin of deciding to live in a nursing home will enter nursing homes. Thus, immigration likely improves both the value of staying at home (with home help) and the value of moving to a nursing home (with increased staff). As a result, the effect of immigration on the number and *selection* of new nursing home residents is theoretically ambiguous.

Next, we turn to the analysis of the effects of immigration on the demand for nursing homes, measured by the number of incoming nursing home residents and their care needs. **Table 6** provides estimates of these effects based on our canonical specification (**Equation 1**). The estimates in column 1 suggest that immigration has a small positive effect on the number of nursing home residents. The 2SLS estimates based on the BCHTT instrument imply that for a 1,000-immigrant inflow, the number of nursing home residents increases by 2.5. It is worth noting that this positive effect on the number of residents rules out the possibility that our earlier findings of *reductions* in the counts of falls (and similar events) might be driven by a reduction in nursing home residents. In fact, the estimated increase in new nursing home residents may be due almost entirely to *foreign-born* individuals that arrived over the previous 5 years and require nursing home care.

Let us now examine whether immigration affects the selection of individuals moving to nursing homes. Specifically, column 2 in **Table 6** estimates the effects of immigration on the average needs of the incoming nursing home residents. The point estimates are positive, both for OLS and 2SLS estimates, but not statistically significant. Hence, while immigration may have had a small positive effect on nursing home admissions, we do not find evidence of an effect on the selection of individuals moving to nursing homes.

5. Immigration and the Supply of Nurses

The previous section has established a relationship between immigration and nursing home outcomes within commuting zones. We hypothesize that a primary mechanism through which immigration flows improve care quality is by increasing the local supply of nurses, and particularly NAs. The goal of this section is to examine this mechanism.

Previous work has shown that immigration increases the local supply of nurse aides and lowers their wages (Furtado and Ortega 2020; Butcher et al. 2022).[28] In this section, we contribute to this literature in two ways. First, we examine whether immigration has led to an increase in the employment of nurses *in nursing homes*. Secondly, we examine whether the immigration-induced increase in nurses is the result of an increase in the number of foreign-born nurses or is due to a displacement of US-born workers into nursing occupations (similar to Peri and Sparber 2009).

Methodology and Data

For each type of nurse occupation, we measure nurse employment using Census and ACS data and estimate variations of the following model:[29]

$$\Delta Nurses_{c,t} = \alpha_{s,t} + \beta\Delta FB_{c,t} + \gamma X_{c,t-1} + \delta\Delta R_{c,t} + u_{c,t} \quad (7)$$

The right-hand side of the model is identical to the model we used to estimate the effects of immigration on nursing home outcomes. Here, the dependent variable is the change in the number of nurses and nursing assistants (who are currently employed and who worked more than zero weeks last year) in commuting zone *c* between year *t* and 5 years earlier.

[28] Interestingly, the wages of registered nurses do not appear to respond to immigration (Cortés and Pan 2014), and if anything, seem to increase (Furtado and Ortega 2020; Butcher et al. 2022). This could be explained by a strong complementarity between nurse aides and registered nurses and immigration increasing the supply of nurse aides *relative* to registered nurses. It is also possible, however, that registered nurses trained abroad (specifically, in the Philippines) are more productive, and so they not only command higher wages for themselves, but also for the native-born nurses who compete with them for jobs.

[29] The number of nurses in year 2000 is based on Census 2000 data, whereas in years 2005 and 2010, it is based on the ACS. In all cases, we use IPUMS-provided person weights to make population estimates of the number of nurses.

We will also estimate a model where the dependent variable is based exclusively on the change in the number of *US-born* nurses, which closely resembles the displacement regressions commonly estimated in the labor-markets immigration literature (e.g. Borjas 2006, Peri and Sparber 2011, Shih 2017). The specifications commonly used in those studies account for cross-city differences in population, either by directly controlling for it or by normalizing key variables by overall population. Our model includes base-year population (in logs) in our vector of controls as well as other commuting zone characteristics such as the share of the population that is above age 65, the share of the population that is black, and the median wage. We also control for characteristics of nursing homes and their residents obtained from the LTCFocus dataset (such as the lags of the average acuity index of nursing home residents, the share of nursing homes that are affiliated with hospitals, etc.). The change in the number of nursing home residents, $\Delta R_{c,t}$, between year t and 5 years earlier helps to control for the change in the demand for nurses resulting from immigrant-induced increases in the commuting zone population. While these variables help account for variation in the demand for nurses, we include them mostly for comparability with the models presented in the previous sections. As before, we address the potential endogeneity of immigration flows through instrumental-variables estimation. In the current context, validity of the instruments requires that they be uncorrelated with current unobserved shocks to the local demand for nurses.

Immigration flows and the local supply of nurses

We will examine impacts separately for the three different types of nursing occupations: registered nurses (RNs), licensed practical nurses (LPNs), and nursing assistants (NAs). We expect immigration to increase the local supply of all types of nurse professionals. However, given that immigrants are most highly represented among NAs, we expect the largest effect of immigration on this nursing occupation. Immigrants make up about 14 percent of the labor force in our sample period, but they account for 17.5 percent of all NAs. In comparison, the immigrant shares among RNs and LPNs are 12.6 and 9.2 percent, respectively (Furtado and Ortega 2020).

Next, we turn to the estimation of the model in **Equation 7**. First, we examine the effects of immigration on the *overall* local supply of nurses and nursing assistants, pooling US-born and foreign-born nurses. The top panel of **Table 7** reports our estimates of the effects of immigration on the employment in all nursing occupations in the commuting zone, regardless of their workplace (nursing home, hospital, school, private residence, etc.), using models that include our whole set of controls and fixed effects. The OLS estimates (at the very top of the table) clearly suggest that immigration increases the supply of nurse professionals, and this increase is primarily driven by nurse aides. Specifically, a 1,000-person increase in the foreign-born population in a commuting zone is associated with an overall increase of 74 nurse professionals in that commuting zone, 58 of which are NAs.

When we turn to the 2SLS estimates (using the BCHTT instrument), we find the same qualitative pattern. However, the magnitudes are now substantially larger. Specifically, a 1,000-person increase in the foreign-born population leads to an overall increase of 163 nurses in the commuting zone. Notably, almost 80% of the overall increase corresponds to NAs (128 individuals), with practically all of the remaining part due to RNs. Reassuringly, the estimates are very similar, though less precisely estimated, when using Card's instrument instead (displayed at the bottom of Panel A, **Table 7**).

The average change in the foreign-born population in a typical commuting zone between 2005 and 2010 was an increase of approximately 6,700 individuals (**Table 1**). Our BCHTT estimates imply that this change leads to an increase in nursing staff of about 227 RNs, 4 LPNs, and 860 NAs. This implies that immigration resulted in a 6.4% increase in the number of RNs, 0.4% increase in LPNs, a 23.0% increase in the number of NAs in the average commuting zone.[30]

Panel B of **Table 7** restricts the analysis to nurse professionals employed *in nursing homes*. The 2SLS estimates based on the BCHTT instrument show that immigration also increases the employment of nurses and nursing assistants *in nursing homes*. Naturally, the magnitude is now much

[30] The average commuting zone had 3,565 RNs, 943 LPNs, and 3,737 NAs in 2005 (**Table 2**).

smaller, as the majority of nurse professionals work in settings other than nursing homes, but the bulk of the increase is again driven by NAs. In terms of magnitudes, recall that our BCHTT estimates imply that a 1,000-person increase in immigration leads to 163 additional nurse professionals (in all workplaces) in the commuting zone. The estimates shown in the bottom panel of **Table 7** imply that 21 of these are employed in nursing homes. Among the latter, 13 are nurse aides and the remaining are the other types of nurses.

Last, the table also reports the 2SLS estimates obtained using Card's instrument. While the pattern is similar, the point estimates are now smaller and standard errors higher, rendering the estimates statistically insignificant. All in all, however, these estimates suggest that immigration to an area increases the number of workers in nursing occupations in general but also specifically in nursing homes. This finding is certainly consistent with immigrants improving the quality of care in nursing homes at least partly by mitigating understaffing, particularly of nurse aides.[31]

Crowding-out or crowding-in of native nurses

Theoretically, the increase in the local supply of labor to nursing occupations can be driven entirely by an increase in *immigrant* nurses and nursing assistants. However, it is also possible that the new immigrants take on other occupations, such as housekeepers, nannies and home care givers (Farré et al. 2011, Furtado 2016, Butcher et al. 2022), and natives become nursing assistants to avoid direct competition with them. After all, Peri and Sparber (2009) document that immigrants push natives to specialize in occupations for which they hold comparative advantage, and Cortés and Pan (2014) find that foreign registered nurses displace natives toward other occupations (in particular, school teachers). Below we also investigate how much of the increase in the number of nurses in commuting zones with

[31] We conducted a falsification test consisting in examining the effect of immigrant inflows on occupations with very low immigrant shares, likely due to implicit or explicit entry barriers (as in Ortega and Hsin 2022). If our identification strategy is valid, we would expect at most low employment effects in these occupations. The estimates corroborate this prediction. The Table is available upon request.

more immigrants is due to immigrants themselves becoming nurses as opposed to natives displaced from other occupations becoming nurses.

Table 8 examines the effect of immigrant inflows to an area on the local supply of *US-born* nurses. A negative coefficient indicates displacement of natives from nursing occupations whereas a positive coefficient points to *crowding-in*. The OLS estimates reported in the top panel strongly suggest crowding-in. Moreover, the effect is almost completely driven by NAs. The 2SLS estimates confirm this finding (middle and bottom panels of **Table 8**). More specifically, as we learned in **Table 7** (2SLS-BCHTT), the arrival of 1,000 immigrants into a commuting zone increases the total number of nurse professionals by 163 (Table 7, Panel A, column 1), 128 of whom are nurse aides (Table 7, Panel A, column 4). Our 2SLS-BCHTT estimates of the effects of immigration on native nurse professionals imply that the 1,000-person immigrant inflow leads to a 58-person increase in the total number of natives in nursing occupations (Table 8, Column 1), 55 of whom are nurse aides (Table 8, Column 4). Thus, 36% (=58/163) of the overall increase in the number of workers in nursing occupations is due to the increase in native nurses in the commuting zone. The comparable figure for nurse aides is 43% (=55/128). Once again, the estimates obtained using the Card instruments are similar, but less precisely estimated.

Our finding of *crowding-in* is consistent with the multiple studies showing that immigration increases the supply of workers providing household services (Farré et al. 2011, Furtado 2016, Butcher et al. 2022). Plausibly, some natives were displaced from low-wage, informal employment in these occupations and pushed into seeking formal employment in elderly care and possibly other occupations as well. Regardless of occupation, employment in a nursing home in a state requiring E-Verify would be difficult for undocumented workers. Moreover, native workers (and foreign-born individuals with proper documentation), seeking to become (certified) nursing assistants only need to complete a short training program, but this credential is not open to undocumented immigrants, at least not in theory.

In contrast, obtaining the credentials to become a registered nurse (or even a licensed practical nurse) entails much larger time and monetary investments. This may explain why our estimates in

Table 8 do not uncover any evidence of crowding-in of natives in these occupations, in stark contrast to our finding for nurse aides. Specifically, we estimated in **Table 7** that a 1,000-person immigration flow into a commuting zone increases the local supply of registered nurses by about 34 individuals (BCHTT), and the comparable estimates in **Table 8** (middle panel, column 2) imply that the totality of that increase was due to foreign-born nurses, rather than crowding-in of natives into this occupation.

Summing up, our analysis shows that immigration increases the local supply of nurse professionals, even controlling for base year population and the change in the number of nursing home residents. Moreover, this increase is mostly driven by an increase in *nurse aides* and this increase is also evident in nursing homes. Thus, our findings in this section support the interpretation that immigration improves the quality of care in nursing homes by mitigating the chronic understaffing of nurse aides. Greater availability of these workers would allow nursing homes to provide more labor-intensive care widely regarded as higher quality. For instance, better-staffed nursing homes can pay more attention to residents (reducing the need for restraints) and help them bathe and go to the restroom more often (reducing the risk of falls and developing pressure ulcers). Our findings also suggest that immigration may have displaced low-skill natives from informal employment as housekeepers and homecare providers toward formal employment as nurse aides, which requires only a small amount of training in order to obtain the certification required to work in nursing homes. The improvements in care quality in nursing homes in high-immigration areas could also reflect an increase in the productivity of nurses and nursing assistants due to immigration (as shown to be the case for registered nurses in Cortés and Pan 2014). Unfortunately, we do not have the data necessary to test this hypothesis.

6. Conclusions

A recent report put out by the National Academies of Sciences, Engineering, and Medicine concludes that the way in which the U.S. finances, delivers, and regulates nursing home care is "ineffective, inefficient, inequitable, fragmented, and unsustainable" (National Academies of Sciences, Engineering, and Medicine 2022). Acknowledging the importance of staffing in delivering quality care, one of the six main goals set forth by the report is to ensure a "well-prepared, empowered, and appropriately compensated workforce." Recommendations for achieving this goal include offering competitive wages and benefits and establishing minimum staffing standards (National Academies of Sciences, Engineering, and Medicine 2022).

A potential barrier to implementing these recommendations, however, is that they can be costly. Hawk et al. (2022) calculate that it would cost 7.25 billion dollars annually, just in salary costs, to meet the proposed minimum staffing levels in bills introduced, but not passed, by the U.S. Senate and House of Representatives in 2019. The COVID-19 pandemic and its aftermath have only made staffing shortages worse and the costs of hiring higher. Our analysis suggests that one potentially effective way to increase staffing in nursing homes at minimal cost is to implement a more open immigration policy. This may be particularly efficient given Hawk et al.'s (2022) findings that the largest shortfalls were in RN and NA staffing, the very occupations in which immigrants are overrepresented.[32]

Our results indicate that immigration improves the quality of care provided in nursing homes at least partly by increasing the supply of nurse aides and thus mitigating the chronic understaffing of nursing homes. In particular, we find that immigration has reduced the number of nursing home residents experiencing falls, pressure ulcers and pain—all direct measures of resident well-being. In addition, we also find reductions in the use of restraints and catheters, which are widely considered to be second-best processes for the delivery of care, induced by understaffing. A recent paper by Grabowski et al. (2023) also analyzes the effects of immigration on the quality of care and staffing of nursing homes in the United States, using more recent data that allows them to overcome some of the limitations in our analysis. They conclude that immigration improves staffing levels at nursing homes and increases the quality of care, largely confirming our main findings.

Interestingly, we find that a substantial part of the increase in the overall supply of nurse aides induced by immigration is driven by *crowding-in* of natives. More specifically, immigrant inflows to

[32] About a quarter of all skilled nursing facilities in the U.S. in 2019 met the total nursing hours per resident day minimum threshold, but only 31 percent met the RN threshold, 85 percent met the LPN threshold, and 11 percent met the NA threshold (Hawk et al. 2022).

an area seem to induce some natives who may have otherwise worked in the (largely informal) household services sector to become (certified) nursing assistants. This occupation only requires a modest investment in a credential that is not viable for immigrants lacking legal status or with a poor command of English. In some sense, this finding is reminiscent of the displacement effects documented by Cortés and Pan (2015) in the context of registered nurses.

During the COVID-19 pandemic, the entire world witnessed the difficulty in caring for people in nursing homes especially in situations of understaffing (see Konetzka et al. (2021) for a systematic review of this growing literature). Our findings suggest that immigration may help build a more effective institutional care system. It is noteworthy that although our study is limited to analyzing the quality of care in nursing homes, the foreign born play a much greater role in the home care market than in nursing homes. There is evidence that immigrant home-care workers allow the elderly and disabled to remain in their own homes instead of going to nursing homes (Butcher et al. 2022), pointing to an additional channel through which a more open immigration policy can help care for an aging population.

References

Adão, R., Kolesár, M. and Morales, E., 2019. "Shift-share designs: Theory and inference," The Quarterly Journal of Economics, 134(4): 1949-2010.

Altonji, Joseph G., and David Card, 1991. "The Effects of Immigration on the Labor Market Outcomes of Less-skilled Natives," NBER Chapters, in: Immigration, Trade, and the Labor Market, pages 201-234, National Bureau of Economic Research, Inc.

Autor, David, and David Dorn. 2013. "The Growth of Low Skill Service Jobs and the Polarization of the U.S. Labor Market." American Economic Review, 103(5): 1553-1597.

Bartel, A. P., 1989. Where Do the New U.S. Immigrants Live? *Journal of Labor Economics*, *7*(4), 371–391.

Basso, Gaetano and Giovanni Peri. 2015. "The Association between Immigration and Labor Market Outcomes in the United States." IZA Discussion Paper No. 9436.

Borjas, George, 2006. "Native Internal Migration and the Labor Market Impact of Immigration," Journal of Human Resources, University of Wisconsin Press, vol. 41(2).

Bostick, Jane, Marilyn Rantz, Marcia Flesner, and C. Jo Riggs. 2006. "Systematic Review of Studies of Staffing and Quality in Nursing Homes." Journal of the American Medical Directors, 7(6): 366–376.

Borusyak, K., Hull, P. and Jaravel, X., 2022. "Quasi-experimental shift-share research designs," The Review of Economic Studies, 89(1): 181-213.

Burchardi, K.B., Chaney, T. and Hassan, T.A., 2019. "Migrants, ancestors, and foreign investments," The Review of Economic Studies, 86(4): 1448-1486.

Burchardi, K.B., Chaney, T., Hassan, T.A., Tarquinio, L. and Terry, S.J., 2020. "Immigration, innovation, and growth," (No. w27075). National Bureau of Economic Research.

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, on the Internet at https://www.bls.gov/ooh/healthcare/ (visited July 20, 2020).

Butcher, Kristin F., Kelsey Moran, and Tara Watson. 2022. "Immigrant labor and the institutionalization of the U.S.-born elderly," Review of International Economics. pages 1– 39.

Card, David. 2001. "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration." Journal of Labor Economics, 19(1): 22-64.

Card, David, and Ethan G. Lewis. 2007. "The Diffusion of Mexican Immigrants During the 1990s: Explanations and Impacts." NBER Chapters, in: Mexican Immigration to the United States, pages 193-228, National Bureau of Economic Research, Inc.

Castle, Nicholas, and Anderson, Ruth. 2011. "Caregiver staffing in nursing homes and their influence on quality of care: Using dynamic panel estimation methods." Medical care, pages 545-552.

Cawley, John, David C. Grabowski, and Richard A. Hirth. 2006. "Factor substitution in nursing homes." Journal of Health Economics, 25(2): 234–247.

Congressional Budget Office. 2013. "Rising Demand for Long-Term Services and Supports for Elderly People." (Online). Available: www.cbo.gov/publication/44370. Referenced: January 2, 2016.

Cooper, Zack, Joseph John Doyle, John Graves, and Jonathan Gruber. 2022. "Do Higher-Priced Hospitals Deliver Higher-Quality Care?" NBER Working Paper No. w29809.

Cortés, Patricia, and Jessica Pan. 2014. "Foreign Nurse Importation and the Supply of Native Nurses." Journal of Health Economics, 37:164-180.

Cortés, Patricia, and Jessica Pan. 2015a. “The Relative Quality of Foreign-Educated Nurses in the United States.” Journal of Human Resources, 50(4):1009-1050.

Cortés, Patricia, and Jessica Pan. 2015b. “Immigration and Occupational Choice of Natives: the Case of Nurses in the United States.” CESifo Economic Studies (Special Issue on Migration), 61(3-4): 797-823.

Cortés, Patricia, and José Tessada. 2011. “Low-Skilled Immigration and the Labor Supply of Highly Educated Women.” American Economic Journal: Applied Economics, 3(3): 88-123.

Escarce, José J. and Lorenzo Rocco. 2018. “Immigration and the Health of Older Natives in Western Europe.” GLO Discussion Paper, No. 228, Global Labor Organization (GLO), Maastricht.

Farré, Lídia, Libertad González, and Francesc Ortega. 2011. “Immigration, Family Responsibilities, and the Labor Supply of Skilled Native Women.” B.E. Journal of Economic Analysis & Policy, 11(1): 1–46.

Foster, Andrew and Yong Suk Lee. 2015. “Staffing Subsidies and the Quality of Care in Nursing Homes.” Journal of Health Economics, 41: 133-147.

Friedrich, Benjamin and Martin Hackmann. 2021. “The Returns to Nursing: Evidence from a Parental-Leave Program.” The Review of Economic Studies, Volume 88, Issue 5, October 2021, Pages 2308–2343.

Furtado, Delia. 2015. “Immigrant Labor and Work-Family Decisions of Native-Born women,” *IZA World of Labor*, Article 139.

Furtado, Delia, 2016. “Fertility Responses of High-Skilled Native Women to Immigrant Inflows,” Demography, 53(1): 27-53.

Furtado, Delia, and Francesc Ortega, 2020. "Does Immigration Improve Quality of Care in Nursing Homes?," IZA Discussion Papers 13552, Institute of Labor Economics (IZA).

Gaynor, Martin, Rodrigo Moreno-Serra, and Carol Propper. 2013. “Death by Market Power: Reform, Competition, and Patient Outcomes in the National Health Service.” American Economic Journal: Economic Policy, 5(4): 134-66.

Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift, 2020. "Bartik Instruments: What, When, Why, and How," American Economic Review, American Economic Association, vol. 110(8), pages 2586-2624, August.

Gowrisankaran, Gautam, and Robert J. Town. 2003. “Competition, Payers, and Hospital Quality.” Health Services Research, 38 (6 Pt 1): 1403–22.

Grabowski, David, Jonathan Gruber and Brian McGarry, 2023. “Immigration, The Long-Term Care Workforce, and Elder Outcomes in the U.S.” NBER working paper 30960, February 2023.

Gruber, Jonathan, and Samuel Kleiner. 2012. “Do Strikes Kill? Evidence from New York State,” American Economic Journal: Economic Policy, 4(1): 127-57.

Hackmann, Martin B. 2019. “Incentivizing Better Quality of Care: The Role of Medicaid and Competition in the Nursing Home Industry.” American Economic Review, 109 (5): 1684-1716.

Harrington, Charlene, Leslie Ross, Susan Chapman, Elizabeth Halifax, Bruce Spurlock, and Debra Bakerjian. 2020. “Nurse Staffing and Coronavirus Infections in California Nursing Homes. Policy, Politics, & Nursing Practice.” Available online at https://doi.org/10.1177/1527154420938707. (Visited July 20, 2020).

Hawk, T., White, E. M., Bishnoi, C., Schwartz, L. B., Baier, R. R., & Gifford, D. R. 2022. "Facility characteristics and costs associated with meeting proposed minimum staffing levels in skilled nursing facilities." Journal of the American Geriatrics Society, 70(4) :1198-1207.

Hirth RA, Zheng Q, Grabowski DC, Stevenson DG, Intrator O, Banaszak-Holl J, 2019. "The Effects of Chains on the Measurement of Competition in the Nursing Home Industry." Med Care Res Rev. 2019 Jun;76(3):315-336.

Hofmann H, Hahn S. Characteristics of nursing home residents and physical restraint: a systematic literature review. J Clin Nurs. 2014 Nov;23(21-22):3012-24. doi: 10.1111/jocn.12384. Epub 2013 Oct 11. PMID: 24125061.

Horn, S. D., Buerhaus, P., Bergstrom, N., & Smout, R. J. 2005. "RN staffing time and outcomes of long-stay nursing home residents: pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care." AJN The American Journal of Nursing, 105(11), 58-70.

Huang, Sean Shenghsiu and John R. Bowblis. 2019. "Is the Quality of Nursing Homes Countercyclical? Evidence From 2001 Through 2015." Gerontologist, 59(6): 1044-1054.

Hurd, Michael, Pierre-Carl Michaud, and Susann Rohwedder. 2014. "The Lifetime Risk of Nursing Home Use," NBER Chapters, in: Discoveries in the Economics of Aging, pages 81-109. National Bureau of Economic Research, Inc.

Iinattiniemi, Sari, Jari Jokelainen, and Heikki Luukinen. 2009. "Falls Risk among a Very Old Home-Dwelling Population." Scandinavian Journal of Primary Health Care, 27(1): 25-30.

Jaeger, David, Joakim Ruist, and Jan Stuhler, 2018. "Shift- Share Instruments and the Impact of Immigration," NBER Working Papers 24285, National Bureau of Economic Research, Inc.

Kelly, Inas, 2020. "The Shock of Falling Among Older Americans." The Journal of the Economics of Ageing, Volume 17, 100123.

Kessler, Daniel P., and Mark B. McClellan. 2000. "Is Hospital Competition Socially Wasteful?" Quarterly Journal of Economics, 115(2): 577–615.

Konetzka, R Tamara, Sally C. Stearns, and Jeongyoung Park. 2008. "The staffing-outcomes relationship in nursing homes." *Health services research* vol. 43 (3): 1025-42.

Konetzka, R. Tamara, Elizabeth M. White, Alexander Pralea, David C. Grabowski, and Vincent Mor. 2021. "A systematic review of long-term care facility characteristics associated with COVID-19 outcomes." Journal of the American Geriatrics Society, 69(10): 2766- 2777.

Leland, Natalie, Pedro Gozalo, Joan Teno, and Vince Mor. 2012. "Falls in Newly Admitted Nursing Home Residents: A National Study." Journal of the American Geriatrics Society, 60: 939–945.

Li, Yue, Helena Temkin-Greener, Shan Gao, and Xueya Cai. 2020. "COVID-9 Infections and Deaths among Connecticut Nursing Home Residents: Facility Correlates." Journal of the American Geriatrics Society. Available online at doi:10.1111/jgs.16689. (Visited July 20, 2020).

Lin, Haizhen. 2014. "Revisiting the relationship between nurse staffing and quality of care in nursing homes: An instrumental variables approach," Journal of Health Economics, 37: 13-24.

LTCFocus. 2021. Public Use Data sponsored by the National Institute on Aging (P01 AG027296) through a cooperative agreement with the Brown University School of Public Health. Available at www.ltcfocus.org. https://doi.org/10.26300/h9a2-2c26.

Mockus, Dominінkas, 2021. "The Effect of Immigration on the Living Arrangements of Elderly Natives."Available at SSRN: https://ssrn.com/abstract=3982734 or http://dx.doi.org/10.2139/ssrn.3982734.

Mukamel, Dana B., Jack Zwanziger, and Kenneth J. Tomaszewski. 2001. “HMO penetration, competition, and risk-adjusted hospital mortality.” Health Services Research, 36(6): 1019–35.

National Academies of Sciences, Engineering, and Medicine. 2022. “The National Imperative to Improve Nursing Home Quality: Honoring Our Commitment to Residents, Families, and Staff.”

National Health Expenditure Accounts (NHEA) 2019. Historical Files, Table 4. Public-use data file and documentation. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical. (Visited July 20, 2020).

Nicolle, L. E. 2014. “Catheter associated urinary tract infections. Antimicrobial resistance and infection control,” 3(1), 1-8.

Ortega, Francesc, and Hsin, Amy, 2022. “Occupational Barriers and the Labor Market Penalty from Lack of Legal Status. Labour Economics”, 76, 102181, DOI information: 10.1016/j.labeco.2022.102181.

Patel, Krishna, and Vella, Francis, 2013. "Immigrant Networks and Their Implications for Occupational Choice and Wages," The Review of Economics and Statistics, MIT Press, vol. 95(4), pages 1249-1277, October.

Peri, Giovanni, and Chad Sparber. 2009. “Task Specialization, Immigration, and Wages.” American Economic Journal: Applied Economics, 1(3): 135-69.

Peri, Giovanni, and Sparber, Chad, 2011. "Assessing inherent model bias: An application to native displacement in response to immigration," Journal of Urban Economics, Elsevier, vol. 69(1), pages 82-91, January.

Propper, Carol, and John Van Reenen. 2010. “Can Pay Regulation Kill? Panel Data Evidence on the Effect of Labor Markets on Hospital Performance,” Journal of Political Economy, 118(2): 222–273.

Rapp, Kelian, Clemens Becker, Sarah Lamb, Andrea Icks, and Jochen Klenk. 2008. “Hip fractures in institutionalized elderly people: Incidence rates and excess mortality,” Journal of Bone and Mineral Research, 23(11): 1825–1831.

Rapp, Kelian, Sarah Lamb, Jochen Klenk et al. 2009. “Fractures after Nursing Home Admission: Incidence and Potential Consequences. Osteoporosis International, 20: 1775–1783.

Ruffini, Krista. 2020. “Higher Wages, Service Quality, and Firm Profitability: Evidence from Nursing Homes and Minimum Wage Reforms,” unpublished manuscript, https://sites.google.com/view/kristaruffini/home/research?authuser=0. (Visited July 20, 2020).

Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. Integrated Public Use Microdata Series: Version 6.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2018.

LTCFocus Public Use Data sponsored by the National Institute on Aging (P01 AG027296) through a cooperative agreement with the Brown University School of Public Health. Available at www.ltcfocus.org. https://doi.org/10.26300/h9a2-2c26.

Shen, Yu-Chu. 2003. “The Effect of Financial Pressure on the Quality of Care in Hospitals.” Journal of Health Economics 22(2): 243–69.

Shih, Kevin, 2017. "Do international students crowd-out or cross-subsidize Americans in higher education?" Journal of Public Economics, Elsevier, vol. 156(C), pages 170-184.

Sisko, Andrea M., Sean P. Keehan, John A. Poisal, Gigi A Cuckler, Sheila D Smith, Andrew J Madison, Kathryn E Rennie, and James C Hardesty. 2019. “National Health Expenditure Projections, 2018-27: Economic and Demographic Trends Drive Spending and Enrollment Growth," Health Affairs, 38(3): 491-501.

Smith, Christopher L., 2012. "The Impact of Low-Skilled Immigration on the Youth Labor Market," Journal of Labor Economics, 30(1): 55-89.

Stevens, Ann H., Douglas L. Miller, Marianne E. Page, and Mateusz Filipski. 2015. "The Best of Times, the Worst of Times: Understanding Pro-cyclical Mortality." American Economic Journal: Economic Policy, 7(4): 279-311.

Takai, Y., Yamamoto-Mitani, N., Okamoto, Y., Koyama, K., and Honda, A. 2010. "Literature review of pain prevalence among older residents of nursing homes." Pain Management Nursing, 11(4), 209-223.

Thomas, K. S., Hyer, K., Castle, N. G., Branch, L. G., Andel, R., and Weech-Maldonado, R. 2012. "Patient safety culture and the association with safe resident care in nursing homes." The Gerontologist, 52(6), 802-811.

Vespa, Jonathan, Lauren Medina, and David M. Armstrong. 2020. "Demographic Turning Points for the United States: Population Projections for 2020 to 2060." Population Estimates and Projections, Current Population Reports. P25-1144

Weech-Maldonado, R., Pradhan, R., Dayama, N., Lord, J., and Gupta, S. 2019. "Nursing home quality and financial performance: Is there a business case for quality?." Inquiry: The Journal of Health Care Organization, Provision, and Financing, 56, 0046958018825191.

Zallman, L., Finnegan, K. E., Himmelstein, D. U., Touw, S., and Woolhandler, S. 2019. "Care for America's elderly and disabled people relies on immigrant labor." Health Affairs, 38(6), 919-926.

Zhao, Xin. 2016. "Competition, Information, and Quality: Evidence from Nursing Homes," Journal of Health Economics, 49: 136-152.

Appendix A: Details on the Construction of the BCHTT Instrument

As noted in **Section 3**, building the BCHTT instrument (Buchardi et al. 2020) involves two steps. Below we provide details on each of the two steps. An even more detailed description can be found in the original paper, along with extensive auxiliary analysis.

The first step in the construction of the BCHTT instrument is building a predictor for the number of individuals living in each county in each year by country of origin (on the basis of ancestry), focusing on non-Europeans. In particular, the predictor for the number of individuals with non-European ancestry *o*, living in county *c*, in year *t,* is based on the cumulative effect of historical push-pull factors dating back to year 1880. Buchardi et al. (2020) start by estimating the following equation separately for each year in their main sample period:

$$A^{NE}_{o,c,t} = \delta_{o,r(c),t} + \delta_{c(o),c,t} + X'_{o,c}\zeta + \sum_{\tau=1880}^{t} a_\tau I^{NE}_{o,-r(c),\tau} \times \frac{I_{Europe,c,\tau}}{I_{Europe,\tau}} + \upsilon_{o,c,t}, \qquad \text{(A.1)}$$

where $A^{NE}_{o,c,t}$ is the total number of people with non-European ancestry *o* (this includes both immigrants and the descendants of immigrants), living in county *c*, in year *t*. $I^{NE}_{o,-r(c),\tau}$ measures the total number of immigrants coming from (non-European) origin country *o* to regions of the U.S. not including county c, in year *t*—in particular, they use the number of immigrants who report in year t that they arrived in the U.S. within the previous five years. This "leave out" technique is meant to ensure that shocks to a particular county (or even region of the U.S.) were not the cause of migration peaks from particular origin countries throughout history.

The relative number of immigrants from Europe living in county *c* in each year (relative to the total number of European immigrants across the U.S. in that year) is used to measure how attractive it was to live in county *c* in that year. Notice that in estimating $A_{o,c,t}$ for t=2010, the last year in the data, the summation symbol covers 130 years of detailed data on migrations from many different foreign countries. **Equation A.1** includes a series of origin country by destination region and continent of origin by destination county fixed effects, and the vector X_{oc} contains bilateral distance between the county and the origin country. The purpose of estimating this equation is to obtain a measure of the weight that should be given to each of the year-specific push-pull interactions, $\hat{a}_{r(c),\tau}$.

The next step is to create predicted values of the number of individuals with different ancestries in each year in each county in the following way:

$$\hat{A}^{NE}_{o,c,t} = \sum_{\tau=1880}^{t} \hat{a}_{r(c),\tau} \left(\widetilde{I^{NE}_{o,-r(c),\tau} \times \frac{I_{Europe,c,\tau}}{I_{Europe,\tau}}} \right) \qquad \text{(A.2)}$$

where the term in parenthesis measures the push-pull factors taking place in year $\tau \leq t$. The time-varying coefficients were obtained in the estimation of **Equation (A.1).** It is also noteworthy that the push-pull interactions (in parenthesis) had been previously residualized (as denoted by the tilde) using a regression model that included the same bilateral controls and fixed effects present in **Equation (A.1)**. This residualization ensures that it is not always the same high-immigrant concentration counties that are considered "booming" throughout the years; Equation A.1 includes county (× origin country continent) fixed effects. The residualization also ensures that it is not always the same immigrant-sending origin countries that are driving especially large immigrant inflows; Equation A.1 also includes origin country (× region of the U.S.) fixed effects. As a result, the main ancestry make-up of a county *c* at a given point in time *t* will be the result of "historical coincidences". Namely, it will be determined by the origin countries that happened to experience especially large emigration to the United States in the years (spanning back to 1880) in which that particular county happened to be booming, relative to its own average.

It is worth highlighting that the *leave-outs* built into **Equation (A.2)** ensure that the emigration flows from the various origin countries to the United States are plausibly uncorrelated with economic conditions in each particular destination, or even its neighboring destinations. It is also noteworthy that the coefficients $\hat{a}_{r(c),\tau}$ in **Equation (A.2)** scale the sequence of historical push-pull factors to take into account that more distant historical events may have a systematically smaller (or greater) influence on current ancestry than more recent events.

The final step in the construction of the BCHTT instrument simply entails building the shift-share instrument for county-level immigration flows during our sample period. Specifically, it requires multiplying the predicted number of individuals with a particular ancestry in the previous (5-year) period by the contemporaneous, nationwide inflow of immigrants from the corresponding origin country, or more accurately, the total number of new U.S. immigrants from that origin, *leaving out* the region in which the county is located:

$$\hat{I}_{c,t}^{NE} = \sum_o \hat{b}_t \left[\hat{A}_{o,c,t-1}^{NE} \times \tilde{I}_{o,-r(c),t}^{NE}\right]. \tag{A.3}$$

Specifically, these predicted immigration flows are constructed on the basis of the predicted ancestry composition, the inflows from each origin into the United States (leaving out the region containing each county observation), and the estimated {b$_t$} coefficients of the following model:

$$I_{o,c,t}^{NE} = \delta_{o,r(c)} + \delta_{c(o),c} + \delta_t + X_{o,c}'q + b_t[\hat{A}_{o,c,t-1}^{NE} \times \tilde{I}_{o,-r(c),t}^{NE}] + u_{o,c,t} , \tag{A.4}$$

which includes origin-country by destination region fixed effects, origin continent by destination county fixed effects, time fixed effects and origin-destination bilateral distance. These estimated coefficients are not important for identification; they simply rescale the interactions.

Despite all of the above, there are still instances that could lead to a violation of the BCHTT exclusion restriction. Consider a local shock that leads to unusually high demand for healthcare professionals in Boston in year 2000. Two scenarios could lead to violations of the BCHTT exclusion restriction. First, the local demand shock could correlate with unusually large arrivals of (non-European) immigrants to the United States in year 2000, leaving out the Northeast (**Equation A.3**). Note though that with the region-leave out technique, we are ruling out situations where the reason for the increase in immigrant arrivals is the plan to work in Boston, or even its surrounding areas.

Another violation could arise if Boston was predicted to have a large population of (non-European) foreign ancestry in the year 2000 because historically, the periods in which Boston's booming economy attracted large shares of European immigrants coincided with episodes of unusually large arrivals of non-European migrants to the regions of the United States outside of the Northeast. This seems rather unlikely.

Tables

Table 1: Descriptive Statistics Nursing Homes. Commuting zone aggregates by year

	Mean	Std. Dev.	Min.	Max.	N
Year 2000					
Foreign-Born Population (thousands), FB	48.3	280.8	0.0	5,229.1	716
5-year Change FB (thousands), DFB	-	-	-	-	-
Residents' Falls	270.2	563.1	0.0	5,190.3	716
Residents' Restrained	209.1	519.5	0.0	9,322.7	716
Residents' Pressure Ulcers, PU	-	-	-	-	-
Residents with ADL Decline	-	-	-	-	-
Residents with Pain	-	-	-	-	-
Residents with UTIs	146.0	342.7	0.0	4,603.2	716
Residents with Catheters	121.8	315.8	0.0	5,042.8	716
Year 2005					
Foreign-Born Population (thousands), FB	55.1	301.2	0.0	5,583.8	713
5-year Change FB (thousands), DFB	6.6	26.4	-4.5	354.7	713
Residents' Falls	247.5	510.3	0.0	5,014.5	713
Residents' Restrained	142.0	391.4	0.0	8,055.5	713
Residents' Pressure Ulcers, PU	46.5	118.7	0.0	1,456.3	713
Residents with ADL Decline	311.4	669.0	0.0	7,173.7	713
Residents with Pain	99.2	205.4	0.0	2,233.0	713
Residents with UTI	158.4	371.8	0.0	4,524.0	713
Residents with Catheters	124.9	323.4	0.0	4,942.1	713
Year 2010					
Foreign-Born Population (thousands), FB	61.9	318.0	0.0	5,700.2	711
5-year Change FB (thousands), DFB	6.7	22.3	-34.8	216.8	711
Residents' Falls	256.5	517.9	0.0	5,171.6	711
Residents' Restrained	60.8	177.8	0.0	3,555.5	711
Residents' Pressure Ulcers, PU	39.5	95.0	0.0	1,206.4	711
Residents with ADL Decline	287.9	612.7	0.0	7,926.1	711
Residents with Pain	67.5	144.0	0.0	1,694.1	711
Residents with UTI	158.2	368.1	0.0	4,377.1	711
Residents with Catheters	114.7	293.7	0.0	4,098.8	711

Notes: Foreign-born population and the 5-year change in the number of foreign-born individuals constructed from the 2000 Census, 2005 ACS, and 2010 ACS. IPUMs-provided person weights used throughout (Ruggles et al. 2008). Data on the measures of nursing home quality were obtained from county-level LTCFocus data for 2000, 2005, and 2010. Individuals in the Census and ACS datasets as well as counties in the LTCFocus data were assigned to 1990 commuting zones using the techniques made available on David Dorn's website (https://www.ddorn.net/data.htm).

Table 2: Descriptive Statistics Nurse Labor Markets. Commuting zone aggregates by year

	Mean	Std. Dev.	Min.	Max.	N
Year 2000					
All Registered Nurses, RN	3,322.6	8,490.9	7.5	97,595.4	716
All Licensed Practical Nurses, LPN	876.9	1,838.1	1.9	24,807.5	716
All Nurse Aides, NA	3,023.3	8,508.6	14.2	160,082.0	716
NH Registered Nurses, RN	280.9	718.7	0.0	9,140.0	716
NH Licensed Practical Nurses, LPN	264.1	525.4	0.0	6,310.0	716
NH Nurse Aides, NA	924.6	1,922.9	2.2	26,685.0	716
NH Non-nurses	1,002.7	2,283.5	3.6	29,440.0	716
Year 2005					
All Registered Nurses, RN	3,564.7	9,010.3	9.2	103,287.5	713
All Licensed Practical Nurses, LPN	942.7	2,030.8	0.0	26,494.0	713
All Nurse Aides, NA	3,736.6	10,305.0	6.3	181,246.0	713
NH Registered Nurses, RN	270.9	723.4	0.0	9,216.0	713
NH Licensed Practical Nurses, LPN	294.1	668.2	0.0	8,266.0	713
NH Nurse Aides, NA	1,125.3	2,440.2	0.0	35,109.0	713
NH Non-nurses	1,043.9	2,332.1	0.0	30,611.0	713
Year 2010					
All Registered Nurses, RN	4,018.7	9,943.3	4.9	126,717.2	711
All Licensed Practical Nurses, LPN	930.6	2,019.8	0.0	28,730.3	711
All Nurse Aides, NA	4,596.9	13,117.2	10.9	219,442.0	711
NH Registered Nurses, RN	306.0	774.2	0.0	8,405.0	711
NH Licensed Practical Nurses, LPN	285.6	614.8	0.0	6,500.0	711
NH Nurse Aides, NA	1,140.5	2,347.7	0.0	28,206.0	711
NH Non-nurses	1,047.6	2,278.5	0.0	29,352.0	711

Notes: Data obtained from the 2000 Census, 2005 ACS, and 2010 ACS (Ruggles et al. 2018). IPUMs-provided person weights used throughout (Ruggles et al. 2008). Individuals in the Census and ACS datasets as well as counties in the LTCFocus data were assigned to 1990 commuting zones using the techniques made available on David Dorn's website (https://www.ddorn.net/data.htm). The first three entries in each panel refer to the number of nurses of each type (RN, LPN, NA) in each commuting zone. The following entries refer to the number of nurses of each type who work in nursing homes (NH). The last entry of each panel considers nursing home workers that are not nursing staff. The sample used to construct this table includes all individuals who are currently employed, work more than zero hours in a typical week, report a non-zero wage, and list occupation and industry of employment.

Table 3: First-stage regressions

	(1)	(2)	(3)	(4)
Dependent Variable:	DFB	DFB	DFB	DFB
BCHTT Z	1.528***	1.264***		
	(0.302)	(0.200)		
Card Z			0.315***	0.258***
			(0.057)	(0.050)
Controls	No	Yes	No	Yes
Observations	1,424	1,423	1,424	1,423
R-squared	0.424	0.581	0.510	0.622
F test	25.59	40.14	30.14	26.88

Notes: DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. Z stands for the predicted value for the change in the foreign-born population based either on Card's or BCHTT's instrument. The units of observation are commuting zones per time period. The periods are 2000-2005 and 2005-2010. All models include state-year fixed-effects and, where indicated, the vector of controls. This vector consists of lagged population (in logs), median wages, the proportion of the population age 65 or higher, and the proportion of individuals self-identifying as black (constructed from Census and ACS data). It also includes average acuity of nursing home residents, the proportion of nursing homes that are for-profit, the proportion that are multifacility, and the proportion that are hospital-based (constructed from LTCFocus data). Standard errors are clustered by state. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Immigration and Main Nursing Home Outcomes. OLS and IV estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Change in	Falls	Restrained	PU	Falls	Restrained	PU
OLS						
DFB	-0.675*	-4.137***	-0.637***	-0.857**	-2.939***	-0.376***
	(0.363)	(0.614)	(0.178)	(0.327)	(0.697)	(0.126)
Observations	1,424	1,424	711	1,423	1,423	710
R-squared	0.365	0.468	0.328	0.510	0.541	0.476
2010 Mean Dep. Var. (level)	256	61	39	256	61	39
IV BCHTT						
DFB	-1.370***	-7.010***	-1.405***	-1.855***	-7.146***	-1.102***
	(0.217)	(0.752)	(0.363)	(0.136)	(0.914)	(0.261)
Observations	1,424	1,424	711	1,423	1,423	710
F stat	25.59	25.59	6.40	40.14	40.14	5.80
IV Card						
DFB	-0.789**	-7.897***	-1.279***	-0.899**	-7.988***	-0.925***
	(0.354)	(1.312)	(0.208)	(0.396)	(1.594)	(0.140)
Observations	1,424	1,424	711	1,423	1,423	710
F stat	30.14	30.14	42.75	26.88	26.88	38.20
Controls	No	No	No	Yes	Yes	Yes

Notes: Top panel reports OLS estimates. Middle and bottom panels report 2SLS estimates using the BCHTT and Card instruments, respectively. DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. The units of observation are commuting zones per time period. Except for pressure ulcers (PU), the periods are 2000-2005 and 2005-2010. For pressure ulcers (PU) only period 2005-2010 can be included. All models include state-year fixed effects. Columns 4-6 also include the vector of controls. This vector consists of lags of log population, median wages, the proportion of the population age 65 or higher, and the proportion of individuals self-identifying as black (constructed from Census and ACS data). It also includes lags of average acuity of nursing home residents, the proportion of nursing homes that are for-profit, the proportion that are multifacility, and the proportion that are hospital-based (constructed from LTCFocus data). Standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Immigration and Additional Nursing Home Outcomes. OLS and IV estimates

	(1)	(2)	(3)	(4)
Dependent Variable: Change in	ADL declines	Pain	UTI	Catheters
OLS				
DFB	-0.781	-0.948***	0.245	-0.214
	(1.241)	(0.257)	(0.156)	(0.168)
Observations	710	710	1,423	1,423
R-squared	0.364	0.641	0.338	0.242
2010 Mean Dep. Var. (level)	288	67	158	115
IV BCHTT				
DFB	-11.241*	-2.909***	-0.129	-1.135***
	(6.212)	(0.566)	(0.454)	(0.218)
Observations	710	710	1,423	1,423
F stat	5.79	5.79	40.14	40.14
IV Card				
DFB	-1.262	-1.941***	0.617	-0.892
	(4.012)	(0.354)	(0.736)	(0.626)
Observations	710	710	1,423	1,423
F stat	38.21	38.21	26.88	26.88

Notes: The top panel reports OLS estimates. The middle and bottom panels report 2SLS estimates using the BCHTT and Card instruments, respectively. DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. The units of observation are commuting zones per time period. For columns 1 and 2, only period 2005-2010 can be included. Periods 2000-2005 and 2005-2010 are used in columns 3 and 4. All models include state-year fixed effects as well as the vector of controls specified in Table 4. Standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Immigration, cohort size and average needs of new admissions to nursing homes. OLS and IV

Dependent Variable: Change in	(1) Number of NH Residents	(2) Average Needs of New Admissions
OLS		
DFB	1.564	0.005
	(1.323)	(0.004)
Observations	1,423	1,414
R-squared	0.280	0.112
IV BCHTT		
DFB	2.500***	0.003
	(0.673)	(0.005)
Observations	1,423	1,414
F test	39.88	40.04
IV Card		
DFB	0.557	0.006
	(0.610)	(0.004)
Observations	1,423	1,414
F test	26.64	26.62

Notes: The average needs of residents upon admission to nursing homes is measured by the average Resource Utilization Group Nursing Case Mix Index. To construct this index, newly admitted nursing home residents are first grouped into categories based on their estimated nursing needs, and then each of these categories is weighted by the relative staff time associated with caring for the average resident in each category and then multiplied by 100. Higher scores represent more severe needs of the residents admitted in the prior year. The dependent variable in column 2 is the five-year change in this average, between 2000 and 2005 and between 2005 and 2010. The top panel reports OLS estimates. The middle and bottom panels report 2SLS estimates using the BCHTT and Card instruments, respectively. DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. The units of observation are commuting zones per time period. The periods are 2000-2005 and 2005-2010. All models include state-year fixed effects and the vector of controls specified in Table 4. Standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Immigration and the local supply of nurses. OLS and IV estimates

	(1)	(2)	(3)	(4)
Dependent Variable: Change in	All	RN	LPN	NA
Panel A: All Workplaces				
OLS				
DFB	74.228***	17.670***	-1.264	57.823***
	(16.614)	(3.971)	(2.257)	(15.341)
Observations	1,423	1,423	1,423	1,423
R-squared	0.505	0.374	0.116	0.511
2010 Mean Dep. Var. (level)	9,547	4,019	931	4,597
IV BCHTT				
DFB	162.852***	33.955***	0.609	128.288***
	(15.125)	(4.670)	(1.018)	(10.685)
F test	40.14	40.14	40.14	40.14
IV Card				
DFB	185.853***	29.196**	-0.712	157.369***
	(29.203)	(14.452)	(4.764)	(26.923)
F test	26.86	26.86	26.86	26.86
Panel B: Nursing Homes Only				
IV BCHTT				
DFB	20.717***	4.263***	2.971***	13.483***
	(2.381)	(0.906)	(0.818)	(1.093)
F test	40.14	40.14	40.14	40.14
IV Card				
DFB	8.512	1.540	1.470	5.502
	(10.505)	(2.496)	(1.748)	(6.529)
F test	26.88	26.88	26.88	26.88

Notes. Within Panel A, the top panel reports OLS estimates. The middle and bottom panels report 2SLS estimates using the BCHTT and Card instruments, respectively. Panel B reports impacts on the number of nurses, of each type, working in nursing homes. Only IV estimates are reported to conserve space. DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. The units of observation in all regressions reported in the table are commuting zones per time period. The periods are 2000-2005 and 2005-2010. All models include state-year fixed-effects and the vector of controls specified in Table 4. Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Immigration and crowding out/in of native nurses in all workplaces. OLS and IV

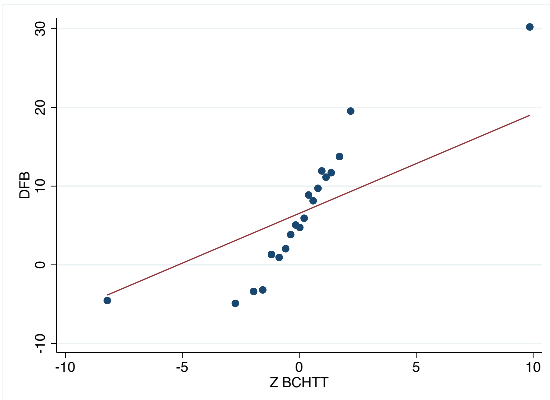
	(1)	(2)	(3)	(4)
Dependent Variable: Change in native-born nurses who work as	All	RN	LPN	NA
OLS				
DFB	22.115***	3.741	-2.116	20.490**
	(8.120)	(2.295)	(1.990)	(7.664)
Observations	1,423	1,423	1,423	1,423
R-squared	0.417	0.240	0.142	0.440
IV BCHTT				
DFB	58.134***	1.364	2.210*	54.560***
	(7.463)	(0.994)	(1.201)	(6.440)
Observations	1,423	1,423	1,423	1,423
F test	40.14	40.14	40.14	40.14
IV Card				
DFB	48.752**	1.502	-2.961	50.212***
	(20.484)	(4.754)	(4.635)	(12.725)
Observations	1,423	1,423	1,423	1,423
F test	26.88	26.88	26.88	26.88

Note: DFB refers to the 5-year change in the number of foreign-individuals in the commuting zone. All models include state-year fixed effects and the full set of control variables specified in Table 4. The dependent variable in column 1 is the number of native-born workers who work as either RN, LPN, or NA. Columns 2-4 consider impacts of immigrant inflows on the number of native-born workers of each type separately. Standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.1

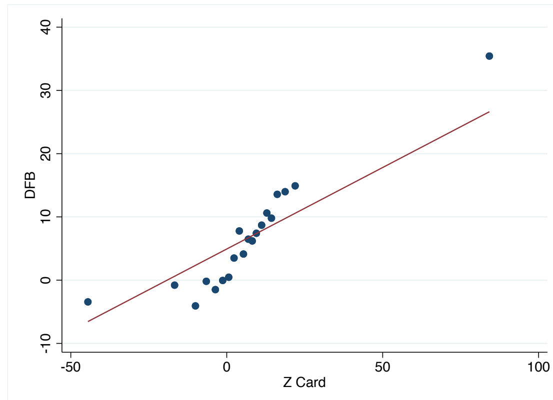
Figures

Figure 1: Actual change in foreign-born population versus prediction, after controlling for lagged population (in logs).

1a: Actual change versus BCHTT prediction



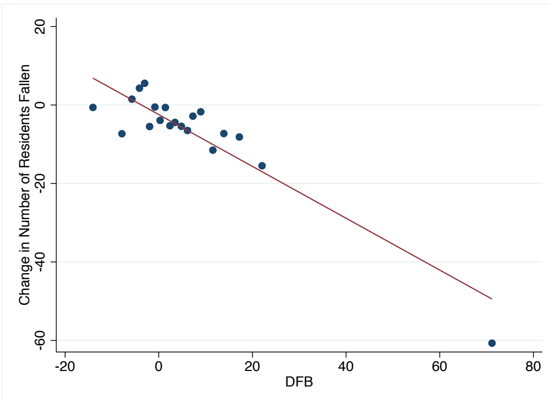
1b: Actual change versus Card prediction



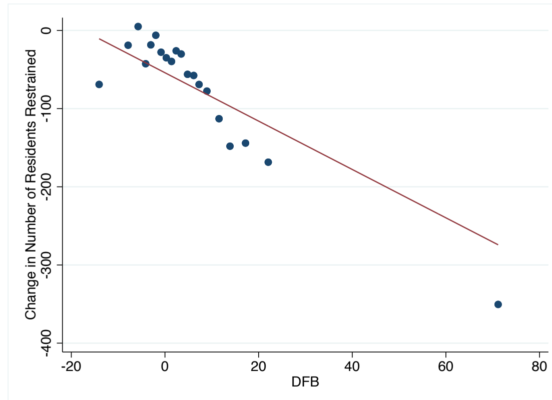
Note: The variable in the vertical axis is the change in the foreign-born population (DFB). The variables in the horizontal axis are the BCHTT-predicted change in the FB population (left panel) and the Card-predicted change in the FB population (right panel). To construct these binned scatter plots, we first residualize the y-axis variable with respect to the log of lagged population (and a constant). We then divide the observations into 20 equal-sized groups (bins) according to the variable in the horizontal axis. In each bin we plot the mean of the y-variable residuals against the mean value for the variable in the horizontal axis. Last, we add back the unconditional mean of the y variable in the estimation sample to facilitate interpretation of the scale. The solid line shows the best linear fit estimated on the underlying microdata using OLS.

Figure 2: Change in Outcomes versus change in foreign-born

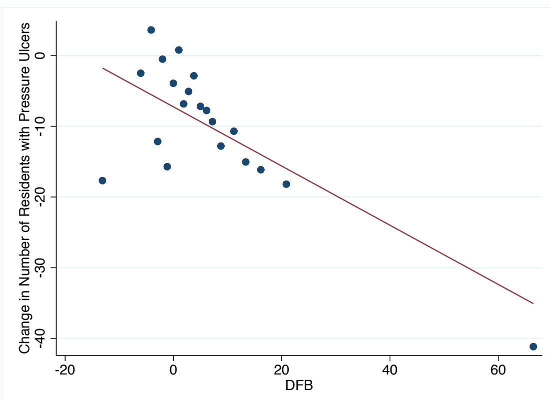
2a. Number of Residents Fallen in last 30 days



2b. Number of Residents Restrained in last 30 days



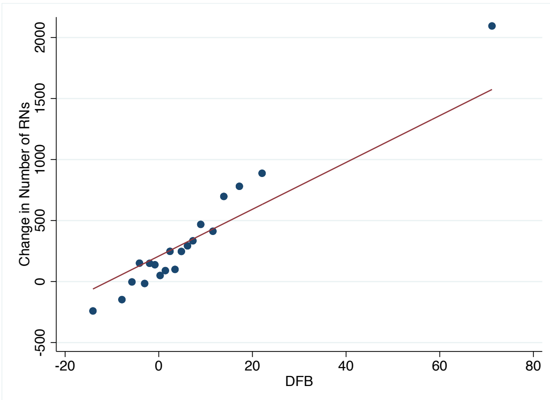
2c. Number of Residents with Pressure Ulcers in last 30 days



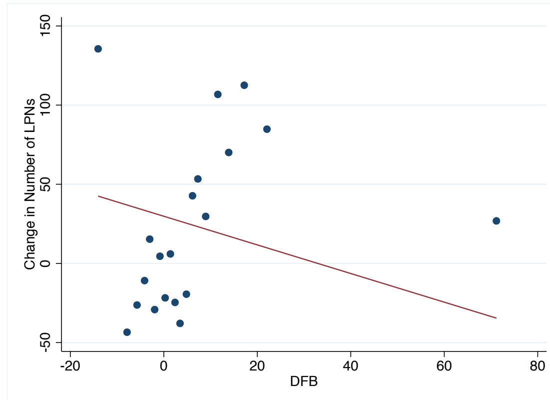
Notes: The variable in the vertical axis of each figure is the change in the corresponding quality of care outcome. The variable in the horizontal axis is the actual change in the foreign-born population (DFB). To construct these binned scatter plots, we first residualize the y-axis variable with respect to the log of lagged population (and a constant). We then divide the observations into 20 equal-sized groups (bins) according to the variable in the horizontal axis. In each bin we plot the mean of the y-variable residuals against the mean value for the variable in the horizontal axis. Last, we add back the unconditional mean of the y variable in the estimation sample to facilitate interpretation of the scale. The solid line shows the best linear fit estimated on the underlying microdata using OLS.

Figure 3: Change in nurses versus change in foreign-born

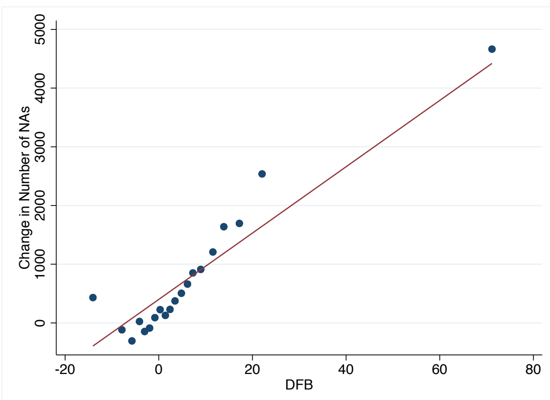
3a. Registered Nurses



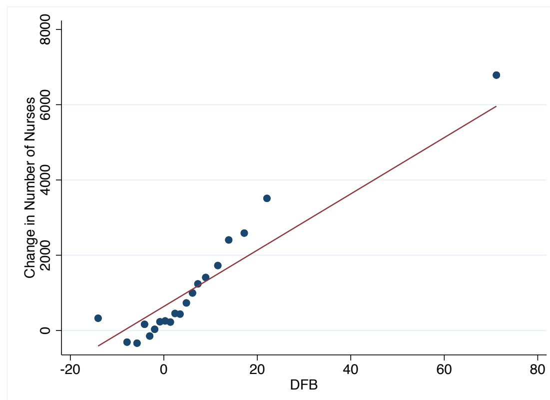
3b. Licensed Practical Nurses



3c. Nurse Aides



3d. All nurses



Note: The variable in the vertical axis of each figure is the change in the number of nurses (of the corresponding type). The variable in the horizontal axis is the actual change in the foreign-born population (DFB). To construct these binned scatter plots, we first residualize the y-axis variable with respect to the log of lagged population (and a constant). We then divide the observations into 20 equal-sized groups (bins) according to the variable in the horizontal axis. In each bin, we plot the mean of the y-variable residuals against the mean value for the variable in the horizontal axis. Last, we add back the unconditional mean of the y variable in the estimation sample to facilitate interpretation of the scale. The solid line shows the best linear fit estimated on the underlying microdata using OLS.