THE UNIVERSITY OF CHICAGO

How does the share of foreign-born workers in nursing-related occupations affect nursing home quality in the United States?

By

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Aug 2021

A paper submitted in partial fulfillment of the requirements for the Master of Arts degree in the Master of Arts Program in the Social Sciences

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Abstract

The aging of larger numbers of Americans will require significant increases in the number of healthcare support workers. During the past years, foreign-born workers are playing a significant role in the direct care workforce in particular. Yet it is not always clear how foreign-born workers fill-in the current gaps. Using ACS (American Community Survey) and LTCFocus (Long-term Care: Facts on Care in the US) data from 2012 to 2016 and measuring quality by facility structures and residents' health outcomes, this paper explores how shares of foreign-born workers in nursing-related occupations may contribute to the quality of nursing homes by applying a longitudinal model with a fixed effect for each nursing home. The result depends on different measures of quality and types of occupations, such as low-skilled occupations like Home Aides assistants and support workers and more professional occupations like registered nurses. I show that when using outcome measures of nursing home quality, such as long-stay residents with daily pain to measure quality, the estimators are generally insignificant, but in terms of Shares of Home Aides Supports occupations, they lead to an increase in quality. However, when using structural measures of nursing home quality, such as different staff ratios, some of the estimators are significant and although in a small attitude, leading to an increase in the quality. Overall, the effect of shares of foreign-born workers in Nursing-related occupations on nursing home quality remains a mixed picture. The result shows that increasing the shares of foreign-born workers itself may not lead to a better quality of nursing home, more effort shall be done to understand the mechanism behind this. Further studies shall focus on

establishing better data and measurement.

1. Introduction

As the US elderly population grows, healthcare workforce shortages are expected to increase in the coming decades. Currently, immigrants are filling health care workforce shortages, playing a significant role in many essential occupations. For example, according to Migration Policy Institute (2020), immigrants accounted for 28 percent of the 958,000 physicians and surgeons practicing in the United States, and 38 percent of the 492,000 home health aides. The immigrant share of healthcare workers was a fraction higher than that of all employed civilian workers ages 16 and over. Even before the COVID-19 pandemic, many healthcare occupations were among the fastest-growing occupations, as projected by the U.S. Bureau of Labor Statistics (BLS) for the 2018-2028 period. In 2018, more than 2.6 million immigrants were employed as healthcare workers, with 1.5 million of them working as doctors, registered nurses, and pharmacists (Altorjai 2017).

Recent studies from Migration Policy Institutes (2020) show that immigrants make up different numbers of shares among certain high- and low-skilled healthcare workers. In 2018, Immigrants accounted for 26.3 percent of the home health aides and nursing assistants (examples of low-skill-required workers) while 15.5 percent of the registered nurses (example of high-skill-required workers) in the United States. Home Health Aides workers and nursing assistant refers to the direct care workers who assist older adults and people with disabilities with daily tasks such as eating, dressing, and bathing at home or in nursing homes. These workers are generally minimum-wage workers and

require neither education higher than postsecondary nor formal nurse training. High-skilled occupations like registered nurses typically have at least a bachelor's degree. They administer care, perform medical tests and monitoring, oversee the work of certified nursing assistants, and act as liaisons to patients' families.

Previous studies have examined immigrants' participation in the direct care workforce and have highlighted the disproportionate role that immigrants play in this workforce (Robert, 2015; Yash et al., 2018; Zallman et al., 2019). However, whether immigrant workers may affect the quality of care provided by nursing homes is rarely discussed and remains unclear. This is perhaps firstly due to the variety in defining quality measures. Measures of resident's outcome performance in nursing homes (for example, proportion of residents who experienced recent fall and proportion of residents with daily pain) and structural characteristics like staff ratio (proportion of registered nurses among all nurses) and staff hours of certain workers per day are generally used in literature. This paper would further explain their validity in the Data section. Secondly, according to the outcome and structural measure of quality, there are different opinions on how immigrant workers may affect the quality of care in nursing homes. Some researchers argue that foreign-born workers may provide an exogenous flow of immigrants thus increase the staffing levels, which is an important indicator in measuring the quality of nursing homes (Furtado and Ortega 2020). In addition, foreign-born workers may provide higher quality care by bringing linguistic and cultural diversity to address the needs of patients of varied ethnic backgrounds (Amah 2018). However, it's also possible that Immigrant workers may ruin the healthcare

outcome if foreign-trained nurses are depressing the wages of domestic nurses, resulting in poor performance and poor-quality patient care (Kaestner and Kaushal, 2012). Some researchers also point out that foreign-born workers face challenges such as communication difficulties, experiences with racism, and marginalization (Banerjee 2012; Hagey et al. 2001). The negative workplace experiences may contribute to low job satisfaction, low morale, and workforce turnover, resulting in the unstable quality nursing home may provide. Overall, while many papers agree that immigrant workers contribute to the development of the healthcare system, there's no consensus on how foreign-born workers contribute to the better quality of nursing homes.

Would higher shares of foreign-born workers fill the current labor shortages and increase staffing levels thus improve nursing home quality? Would higher shares of foreign-born workers experiencing a stronger level of cultural and racial discrimination and language barrier thus alternatively impair nursing home quality? Would foreign-born workers have more effect on basic patient care such as nursing assistants or in high-skilled occupations such as registered nurses? Based on the relevant research and the fact that difference in shares exists in low-skilled and high-skilled occupations, I'm interested in the following question: what is the relationship between the share of immigrant workers in different nursing-related occupations and the quality of nursing homes?

2. Literature Review

Many studies have examined immigrants' participation in the direct care workforce and have highlighted the disproportionate role that immigrants play in this workforce

(Robert, 2015; Zallman et al., 2019). For example, Robert Espinoza (2018) provides a statistical overview of the composition of direct care workers. He shows that the proportion of direct care workers who are immigrants grew from 20 percent in 2005 to 24 percent in 2015 with an increase of 340,000 people in direct care workers from 520,000 to 860,000. 20 percent of the workers working in nursing homes are immigrants in 2015, making them an indispensable force in the long-term health sector.

How foreign-born workers affect the quality of care remains contentious. From a theoretical perspective, an exogenous inflow of immigrants to a location may improve the quality of care - if this increase in the supply of workers lowers equilibrium wages in nursing occupations, then nursing homes may respond by hiring more workers, reducing patient-nurse ratios, and thus improving the quality of care (Furtado and Ortega 2020). Even if the number of nurses does not change, it's also possible that foreign-born workers may provide higher quality care to nursing home patients: Immigrant health care workers are on average more educated than US-born workers (Altorjai 2017) and they could bring linguistic and cultural diversity to address the needs of patients of varied ethnic backgrounds (Amah 2018). However, it's also possible that Immigrant workers may ruin the healthcare outcome if foreign-trained nurses are depressing the wages of domestic nurses. as Kaestner and Kaushal (2012) point out that the future domestic supply of nurses may shrink, exacerbating the apparent nurse shortage and worsen the supposed consequences of the shortage such as poor-quality patient care. In addition, foreign-born workers face challenges such as communication difficulties, experiences with racism, and marginalization (Banerjee

2012; Hagey et al. 2001). The negative workplace experiences may contribute to low job satisfaction, low morale, and workforce turnover, resulting in the unstable quality nursing home may provide. The serious consequences of negative workplace experiences and the frequency with which they are reported by foreign-born and foreign-educated health workers may suggest that the existing workforce is not being optimally supported and quality could be improved by properly managing this issue.

Although previous studies provide statistical portraits of the immigrant workers in the healthcare sector, relations between the characteristics of immigrant workers and the performance of the healthcare facilities are rarely explored. A few quantitative studies focus more on the wage and labor side. For example, Kaestner and Kaushal (2012) study the Effect of Immigrant Nurses on Labor Market Outcomes of US Nurses by focusing on the effect of immigration in the labor market defined by states. They find that immigration by foreign-trained nurses increases the supply of nurses and that this increase in supply is associated with a decrease in annual earnings. A more recent study by Furtado and Ortega (2020) shows that immigrant inflows are associated with reduced wages of lower-skilled nurses along with increases in their employment. They also show that more immigrant labor leads to fewer falls among residents and improvements in other measures of quality of care.

Based on the previous study, the hypothesis I have is that in recent years, the share of foreign-born workers working in basic patient care (Such as Home Health Aides and Healthcare Support workers) is positively associated with the quality of nursing homes. While for high-skilled occupations (Such as Registered Nurses), shares of foreign-born

workers may not have much direct influence on nursing home quality.

This paper adds to the literature that aims at exploring immigrants' support for the US healthcare sector. The main contribution of this paper is to explicitly link shares of foreign-born workers in nursing-related occupations to a wide array of measures in quality of care provided in nursing homes. In addition to statistical reports of shares in different states, this paper aims at exploring the relationships by applying a longitudinal model with fixed effect of each nursing home. This paper may also provide policy insights especially in the Covid-19 pandemic, during which immigrants workers were already contributing a lot to the US healthcare system. Under this circumstance, whether to offer more assistance and focus on immigrants may help the United States combat the Covid crisis in the healthcare area.

3. DATA

This paper explores the relationship between shares of foreign-born workers in nursing-related occupations and the quality of care provided in nursing homes. Data used in this paper comes from two separate databases: IPUMS and LTC-focus. IPUMS contains harmonized census and American Community Survey (ACS) data from 1790 to the present. For the period since 2000, IPUMS provides annual ACS public use samples. The available information in the censuses and ACS varies by year, but generally includes demographic data, economic data, and other individual characteristics. Data relates to key variables (weighted shares of foreign-born workers in nursing-related occupations across states) would be extracted from IPUMS dataset that contains ACS data.

To measure nursing home outcomes, this paper would rely on the Long-Term Care Focus (LTCFocus) dataset developed as part of the Shaping Long-Term Care in America Project at Brown University. LTCFocus integrates data from the Online Survey Certification and Reporting System (OSCAR), the Minimum Data Set (MDS), and data from Nursing Home Compare. OSCAR data are collected during annual nursing home inspections by state survey agencies. The MDS is comprised of self-assessments by all Medicare- or Medicaid-certified nursing homes at regular intervals. As part of these assessments, information on each resident's health, physical functioning, mental status, and general well-being is collected and then aggregated at the nursing home level. The Nursing Home Compare data was developed by the Centers for Medicare & Medicaid Services (CMS) as a public service to allow consumers to easily compare the quality of care provided in different nursing homes. The richness of the datasets allows this paper to extract many quality-related variables of nursing homes.

The challenge is how to define Nursing home Qualities. Donabedian's SPO approach is somewhat pervasive in the quality literature in conceptualizing and organizing quality indicators (Castle et al., 1996). Castle et al. reviewed and found that in MEDLINE (2005–2010), 57% (N = 3,950) of nursing home studies either directly or indirectly applied this approach of conceptualizing quality indicators. Theoretically, Donabedian proposed that quality could be measured in terms of structures (S), processes (P), and outcomes (O). Structural measures are the organizational characteristics associated with the provision of care. Process measures are characteristics of things done to and for the resident. Following his idea, one of the

possible measures of the quality of care provided in a nursing home facility is the proportion of residents who have recently fallen, which is related to the outcome in the SPO approach. To be a valid indicator, the change in residents' health status (i.e., outcome) must be attributable to prior care (i.e., under the control of the provider). This measure of the quality of care has been shown to trigger health deterioration and even increased mortality with a fairly high probability (Kelly 2018) and is already used in the previous study (Furtado 2020), thus it could a good measure in terms of outcomes.

With the above considerations, one of the main measures for quality would be the proportion of residents who have recently fallen. It has been shown to trigger health deterioration and even increased mortality with a high probability (Kelly 2018; Rapp et al. 2008, 2009). Moreover, as Furtado et al. suggest that immigrants are highly represented among nursing assistants (2020), and there is evidence that resident falls are particularly sensitive to nurse assistant staffing (Leland et al. 2012). This may be because nursing assistants are the ones assisting during toileting and transfers when many of the falls occur (Furtado et al 2020). Following the previous reasons, I believe that if immigrants have an impact on nursing home quality, there shall be an impact on falls. Indeed, I also exploit the abundance of information by considering several other indicators of quality of care in nursing homes. Quality indicators such as the share of residents who have experienced declines in their abilities to perform activities of daily living (ADLs), Proportion of long-stay residents with ADL decline, the percent of residents reporting daily pain, Proportion of low-risk long-stay residents with pressure ulcers, which provides a comprehensive measure of the evolution of the health of

residents over time. If shares of foreign-born workers do affect the quality. We shall observe that the shares better all of the outcome quality indicators.

However, there's always difficulty in isolating the facility effect: many outcomes are influenced by genetic, environmental, or other factors unrelated to care. In this case, care is only one of several determinants of health status. Thus, the staffing level of the nursing home and patient-nurse ratio are some other constructs related to structural measures that can affect the quality level. Literature associates more Registered Nursing (RN) hours, or more RN hours as a proportion of total staff hours, with better patient outcomes as measured by various process and outcome indicators. (Cohen and Spector 1996). However, empirical studies also found no such relationship exists (Castle 2008) Although structural quality indicators are considered important for assuring quality, Donabedian (1988) viewed it as "necessary but not sufficient." I'll construct structural quality indicators by having dchrppd (Direct-care staff hours per resident day), cnahrppd (Certified Nursing Assistant (CNA) hours per resident day), rnhrppd (RN hours per resident day), and lpnhrppd (Licensed Practical Nurse hours per resident day) In all, I can establish convergent validity by evaluating both measures. As is discussed previously, staffing hours could either be the consequence or appear as a controlled variable of nursing homes. This study will first treat them as the quality measurement and then add them into the nursing home characteristics to see if staffing level would make a difference on the key variables.For the explanatory variable, the main variable here is the state-level shares of immigrant workers in specific nursing-related occupations. In terms of Occupations, this paper used the category "Registered

nurses" (Code number 3255) to represent registered nurses, "Licensed Practical and Licensed Vocational Nurses" (Code number 3500) to represent Licensed Practical and vocational Nurses. However, for the general nurse assistant and healthcare support worker, there are two categories that could be representative: First is "Nursing, Psychiatric, and Home Health Aides" (Code number 3600), Second is "Healthcare support workers, all other, including medical equipment preparers"(Code number 3655) which used to be "Medical assistants and other healthcare support occupations, except dental assistants" before 2010. Thus, the foreign-born ratio of Registered Nurses, Licensed Nurses, General Nurse assistant in each state would be calculated by the mentioned data and for the General Nursing worker, this paper would test on two sources.

In terms of controls at the nursing home level, this paper would also add average acuity index, log of the number of beds, hospital based, for-profit and multi-facility indicators. In choosing the nursing-home controls to include in our models, I follow Furtado and Ortega's idea in analyzing effect of Immigration and the quality of care in nursing home quality to maintain consistency.

Since the impact on statistical analysis depends on the distribution of the data (for example, symmetric or skewed), the number of clusters, and the number of observations per cluster. In this case this paper adopted the weight methods to calculate shares of foreign-born workers across the states. However, due to the sample size of 1-year-estimated ACS data, some states produce extreme ratios: For example, share of healthcare support workers equals to 1 only in Alaska in 2016 and 2013, which might

not be trustful. In this case, I drop this state to remove the outliers.

In addition to statistical reports of shares in different states, this paper would explore the relationships by applying a longitudinal model with fixed effect of each nursing home.

4. Empirical Strategy:

This paper used longitudinal nursing home fixed-effects strategy to examine how the share of foreign-born workers affects quality in nursing homes, with the variation across states and over time. To analyze the effect of the shares of foreign-born-workers in healthcare service on nursing home quality, I estimated the following regression:

$$Quality_{nst} = \alpha Shares_{st} + \beta N_{nst} + \tau_t + \gamma_n + \varepsilon_{nst}$$

where outcome of interest is the quality measurement of nursing home n, located in state s, in year t. I control for vector of nursing home characteristics N_{nst} time fixed effects τ_t ,nursing home fixed effects γ_n and error term ε_{nst}. I consider Quality separately for

Fixed effect model is used because it can remove the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome. Given that each state and nursing home has its own individual characteristics that may influence the predictor variable, fixed effect model is adopted in this paper. In this case, the facility fixed effects account for any facility time-invariant unobservable factors that affect the outcomes of interest. While facility characteristics vector controls for the varying observable factors affect the outcomes of interest, the facility fixed effects account for any facility time-invariant unobservable factors that affect the outcomes of

interest. They also subsume the state fixed effect. The year fixed effects controls for any systematic trends in quality that affect all nursing homes during 2012 to 2016.

While one thing needs consideration is that the predictor variable, shares of foreign-born worker in different nurse-related occupations are at the level of state, and we assume that shares at state-level are similar to that at county-level. This is a strong assumption given the limitation of the Ipums data. I cannot find more accurate estimates with current datasets. Considering the above issues, I take the state level predictor variable of shares of foreign-born workers in nursing-home-related occupations, mostly the nurses, healthcare support workers and home health aides.

Furtado et al. (2020) find improvements in the quality of care provided in nursing homes in areas with a higher share of immigrants in the population, following from their idea, I hypothesize a more specific view that among all foreign-born-shares of nursing related occupations, shares relate to Nursing and Home Health aides, and Healthcare support workers would have a stronger positive effect on the quality of Nursing Home.

5. Results

Table 1 presents descriptive statistics of the state-level variables I use in our analysis. By construction the weighted shares of foreign-born workers in Healthcare Support workers, Nursing and Home Health Aides, Licensed Practical and Licensed Vocational Nurses and Registered Nurses. As is reported in the table, the range of shares varies a lot across states, especially for Occupations such as Nursing and Home Health Aides.

Table 2 presents descriptive statistics of the nursing home level outcome variables I use in the analysis: Measures of the prevalence of falls, rates of ADL decline, reports of daily pain, pressure ulcers etc.

Table1. Descriptive Statistics on Shares through 2011-2016

Occupations	Mean	St. Dev.	Min	Max
Healthcare_Support_Workers	0.11	0.10	0.00	0.44
Nursing and Home Health_Aides	0.17	0.16	0.02	0.66
Licensend_Practical_Nurse	0.09	0.08	0.001	0.37
Registered_Nurse	0.10	0.09	0.01	0.39

Table2. Descriptive Statistics of nursing home variables through 2011-2016

Nursing home characteristics	Mean	St. Dev.
% of Residents Fall	22.13	0.04
% of Residents with Daily Pain	8.23	0.03
% of Residents with pressure Ulcer	6.04	0.02
% of Residents with ADL Decline	15.41	0.03
Average Acuity Index	12.04	0.01
Restrain	1.79	0.02
Average Age	79.8	0.03
Total beds	106.9	0.22

To be consistent with analysis from Furtado and Ortega (2020), I first use proportion of fall (Proportion of residents present on the 1st Thursday in April who have fallen in the last 30 days.) as outcome variable. **Table 3** presents OLS estimates when percentage of falls is the quality measure. All the estimates contain time fixed

effect and column 2 contains nursing home fixed effect and controlled nursing home characteristics discussed earlier. None of the shares is significant and all of them have positive signs, indicating the higher the shares of foreign-born workers in one state, the higher the proportion of fall in a nursing home. This is completely different with what Furtado and Ortega (2020) got in their analysis. The reason might be that they are using the shares of foreign-born people in the commuting zones where Nursing home located while I am using a state level shares of foreign-born worker in nursing-related occupations. While my predictor is more specific with respect to occupation, their measure is more specific with respect to geography, there are many possible difference that cause this paper to get different results.

Table 3: Outcome measures of percentage of falls

	Dependent variable:	
	Proportion of Fall	
	(1)	(2)
Home Health Aides and nursing	0.154	0.116
	(0.796)	(0.797)
Healthcare Support worker	0.267	0.255
	(0.425)	(0.425)
Licensed Practical Nurse	0.476	0.430
	(0.918)	(0.918)
Registered Nurse	2.932	2.955
	(2.172)	(2.171)
Nursing Home Fixed effect	No	Yes
Observations	50,352	50,351
R^2	0.0001	0.001
F Statistic	0.605 (df = 4; 36766)	4.358^{***} (df = 12; 36757)
Note:		*p**p***p<0.01

Next, I turn to other measures of the quality of care provided by nursing homes that are closely connected to the tasks usually conducted by nurses. All of them are categorized as "quality measured" in LTC-Focus data, including Proportion of long-stay residents with ADL(levels of activities of daily living) decline, Proportion of long-stay residents with daily pain, Proportion of low-risk long-stay residents with pressure ulcers. **Table 4a** presents the result of different dependent variables. Although some of the increases in shares are related to higher nursing home quality, not all of them are significant. Column 1 shows the result when the proportion of residents with daily pain is the quality measure. The estimate for shares in Home Health Aides and Nursing-related occupations is negative and significant at 5% level. Suggesting that for a 1% increase in shares of Home Health Aides and nursing-related occupations, the proportion of residents with daily pain in a nursing home would decrease by 1.5%. It's possible because while RNs and LPNs can administer pain medication, motivated and perceptive nursing assistants may call attention to the fact that a resident is experiencing pain before it becomes severe. Column 2 shows the result when the proportion of residents with ADL decline is the quality measure. As we can see, LPN and RN ratios are positive and significant at 5 % level. I am unsure about the reason. One potential reason is that estimates in this column have wrong signs as a result of sampling error as they are much bigger than other estimates. A more possible explanation is that there might be a endogeneity problem: If states with more quality problems are those that attract more immigrants, then it may look as if foreign-born workers make the quality worse. I'll check this reverse causality issue with lagged variable in next section.

Column 3 shows the result when the proportion of pressure ulcers is the quality measure. Again, Shares of Home Health Aides and nursing-related occupations is negative but significant only at 10% level.

As is discussed earlier, staffing hours could be either the outcome measure or a mechanism for shares of foreign-born workers to have effect on qualities. Thus, I put the staffing hours of four types of workers first in the controlled characteristics to see if they significantly influence the outcome. Control variables are dchrppd (Direct-care staff hours per resident day), cnahrppd (Certified Nursing Assistant (CNA) hours per resident day), lpnhrppd (Licensed Practical Nurse hours per resident day) and rnhrppd (Registered Nurses hours per resident day). The result in **Table 4b** shows that except for an increase in standard error and minor change in point estimates, significance level remains the same. This result indicates that the relation between staffing ratio and foreign-born shares may not be explicit.

Table 4a: Outcome measures of Nursing Home Quality

	Dependent variable:		
	% with daily pain	% with ADL decline	% with pressure ulcers
	(1)	(2)	(3)
Home Health Aides and nursing	-1.566**	-1.134	-0.993*
	(0.756)	(1.006)	(0.512)
Healthcare Support worker	0.150	0.513	0.070
	(0.407)	(0.538)	(0.272)
Licensed Practical Nurse	-0.478	2.522**	0.447
	(0.876)	(1.163)	(0.581)

Registered Nurse	0.088	5.927**	0.691
	(2.078)	(2.761)	(1.400)
Observations	60,380	63,729	57,983
R^2	0.005	0.006	0.003
F Statistic	16.210*** (df = 13; 46397)	24.167*** (df = 13; 49463)	11.003*** (df = 13; 44383)
Note:			*p**p***p<0.01

Table 4b Outcome measures adding staffing hours as controls

	Dependent variable:			
	% of Fall	% with daily pain	% with ADL decline	% with pressure ulcers
	(1)	(2)	(3)	(4)
Home Health Aides and nursing	0.193	-1.580**	-1.170	-0.983*
	(0.797)	(0.757)	(1.010)	(0.512)
Healthcare Support worker	0.259	0.241	0.486	0.068
	(0.426)	(0.407)	(0.539)	(0.273)
Licensed Practical Nurse	0.430	-0.588	2.570**	0.448
	(0.919)	(0.877)	(1.170)	(0.582)
Registered Nurse	2.920	0.135	5.930**	0.639
	(2.180)	(2.080)	(2.770)	(1.400)
Observations	50,210	60,197	63,543	57,806
R^2	0.002	0.004	0.006	0.003
F Statistic	3.510*** (df = 16; 36623)	13.000*** (df = 16; 46221)	19.800*** (df = 16; 49281)	9.150*** (df = 16; 44216)
Note:				*p**p***p<0.01

Finally, I use the staffing hours to measure the quality. As mentioned earlier, there are four structural measures of nursing home quality: dchrppd (Direct-care staff hours

per resident day), cnahrppd (Certified Nursing Assistant (CNA) hours per resident day), lpnhrppd (Licensed Practical Nurse hours per resident day) and rnhrppd (Registered Nurses hours per resident day). Table 5 presents OLS estimates for a variety of outcomes. All the estimates contain time fixed effect and nursing home fixed effect and controlled nursing home characteristics discussed earlier. The dependent variable in the first column is the measure of Direct-care staff hours per resident day in the nursing home. Although 3 of the estimates are positive, none of them are significant, the only estimate significant in 10% level is the shares of foreign-born workers in LPN, suggesting that for 10% increase in LPN ratio, the overall Direct-care staff hours per resident day in a nursing home would decrease by 0.01 hour, which is rather small. Given that licensed practical nurses (LPN) typically provide assistance to doctors or registered nurses, resulting in the first column suggests that shares of foreign-born workers in given nursing-related occupations may not necessarily affect Nursing home quality. There might not be a special pathway for Foreign-born workers in LPN to increase the overall nursing hours per resident day. For the second column, Certified Nursing Assistant (CNA) hours per resident day, none of the estimates is significant. For the third column, Licensed Practical Nurse hours per resident day, the share of foreign-born workers in Health support occupations is positive and significantly different from zero in 1% level, although very small (0.072). The fourth column corresponds to the Registered Nurses hours per resident day. The result shows that the share of foreign-born workers in registered nurses is positive (0.244) and significantly different from zero in 1% level. Registered nurses are nurses who provide direct care

to patients. Licensure as a registered nurse is generally sought after graduation from a 4-year undergraduate nursing program and successful completion of the NCLEX-RN (National Council Licensure Examination), indicating an overall higher level of education and capability. A positive and significant estimate of foreign-born shares in Registered nurses on their duty hours per day may suggest that in terms of positions requiring higher education, more foreign-born workers may increase the staff hours in Nursing homes. Even though registered nurses cost higher than direct care staff. Due to the increasing number of foreign-born workers, foreign-born workers may increase the supply of registered nurses, enabling nursing homes to hire more of them.

Table5: Structural measure of Nursing Home Quality

	Dependent variable:			
	Direct-care staff	CNA	LPN	RN
	(1)	(2)	(3)	(4)
Home Health Aides and nursing	0.008	0.003	0.051	-0.031
	(0.077)	(0.061)	(0.038)	(0.027)
Healthcare Support worker	0.065	0.037	0.072***	-0.012
	(0.041)	(0.033)	(0.020)	(0.014)
Licensed Practical Nurse	-0.149*	-0.112	0.008	0.005
	(0.088)	(0.070)	(0.043)	(0.031)
Registered Nurse	0.125	0.194	0.037	0.244***
	(0.212)	(0.169)	(0.104)	(0.074)
Observations	75,181	75,203	75,425	75,437
R^2	0.003	0.006	0.002	0.007
F Statistic	15.774*** (df = 12; 59592)	29.054*** (df = 12; 59613)	12.057*** (df = 12; 59832)	35.091*** (df = 12; 59842)
Note:				*p**p***p<0.01

6. Robustness Check

In order to test the robustness of my results, I run a series of robustness checks. First, as is mentioned earlier, the weakness of using the fixed effect model may cause surprising directions: fixed effect model may suffer from reverse causality and simultaneity problems. One way to explore whether reverse causality is a problem is to run a lagged regression, which uses temporality to improve the plausibility of the direction of effect. Although the time range of my data is not long (from 2012 - 2016) and adding lagged variables may result in a decrease in observations, lagged regression can still help me identify whether there exist severe reverse causality or simultaneity issues. Table 8 presents the estimates adding lagged variables. The result shows that after adding a one-year lagged variable, the estimates don't vary a lot: for pain 0.116 vs 0.245 -1.500 vs -1.566, -1.480 vs – 1.134 and -0.993 vs -0.979 before and after adding lagged variables in proportion of residents fall, proportion with daily pain, proportion with ADL decline and proportion with pressure ulcers. Standard deviations neither change a lot. However, the significance level dropped from 5% to 10% for shares of Home Health Aides on proportion of residents with daily pain and proportion of residents with pressure ulcers. Overall, the result suggests that the reversed causality issue may not be a problem in this analysis.

Table8: OLS Estimates with lagged variables

	Dependent variable:			
	% of Fall	% with daily pain	% with ADL decline	% with pressure ulcers
	(1)	(2)	(3)	(4)
Home Health Aides and nursing	0.245	-1.500*	-1.480	-0.979*
	(0.878)	(0.769)	(1.010)	(0.519)

Healthcare Support worker	0.469	0.215	0.863	-0.0004
	(0.458)	(0.414)	(0.541)	(0.277)
Licensed Practical Nurse	-0.878	-0.348	1.820	0.554
	(1.020)	(0.897)	(1.180)	(0.592)
Registered Nurse	1.310	-0.845	5.600**	0.990
Home Health Aides and nursing	(2.360)	(2.110)	(2.770)	(1.420)
Observations	40,589	55,330	59,813	52,982
R^2	0.013	0.008	0.028	0.017
F Statistic	30.400*** (df = 13; 29032)	25.600*** (df = 13; 42550)	103.000*** (df = 13; 46446)	55.200*** (df = 13; 40878)
Note:				*p**p***p<0.01

Second, since there are much difference comparing results Furtado and Ortega's analysis (2020) with this paper, I would like to address the minor difference between theirs and mine. Firstly, my measure is more specific with respect to occupation while their measure is more specific with respect to geographical locations. Second, both of us controls time fixed effect while I'm using a more conservative nursing home fixed effect model with nursing home characteristics, their models contain nursing home characteristics with the state fixed effect, commuting zone fixed effect and nursing home fixed effect, respectively. Although their results are mostly consistent and significant, suggesting higher immigration shares in a certain commuting zone could result in better quality of nursing home, the significance level dropped a lot from 1% to 10% when switching from nursing home characteristic with only or no state fixed effect to commuting zone fixed effect or nursing home fixed effect. In order to better understand what may cause the inconsistency of my result and theirs, I also relax my model with state fixed effect, nursing home fixed effect or only nursing home

characteristics.

Table 9 shows the result when nursing home characteristics are the only controls considered. I used the same controlled characteristics as theirs. All the coefficients become significant. Especially for proportion of residents fall. In my previous analysis using nursing home fixed effect, the estimate is positive and insignificant. The outcome suggests that when controlling for nursing home characteristics and time fixed effect, my results start to be consistent with Furtado and Ortega's, indicating that their result may be biased by unmeasured characteristics of nursing homes. The exception is the % of residents with ADL decline. What also remains puzzling is the estimate for proportion of residents with pressure ulcers. Our estimates are both positive and there doesn't seem to have a proper explanation.

Table 9: model with only nursing home characteristics

	Dependent variable:			
	% of Fall	% with daily pain	% with ADL decline	% with pressure ulcers
	(1)	(2)	(3)	(4)
Home Health Aides and nursing	-2.460***	-2.860***	1.200***	1.070***
	(0.413)	(0.358)	(0.414)	(0.217)
Healthcare Support worker	2.120***	1.530***	1.400**	-0.461
	(0.556)	(0.498)	(0.571)	(0.304)
Licensed Practical Nurse	-1.230	-5.170***	-11.100***	-3.600***
	(0.870)	(0.776)	(0.891)	(0.467)
Registered Nurse	-11.700***	-3.000***	1.400	4.740***
	(0.878)	(0.769)	(0.887)	(0.469)
Observations	50,210	60,197	63,543	57,806
R^2	0.260	0.057	0.026	0.068

F Statistic	1,104.000*** (df = 16; 50189)	225.000*** (df = 16; 60176)	107.000*** (df = 16; 63522)	264.000*** (df = 16; 57785)
Note:				*p**p***p<0.01

Table 10 shows the result when adding the state fixed effect. All the coefficients become insignificant. This time for proportion of residents fall the estimate became negative though still insignificant. The outcome suggests that when controlling for nursing home characteristics, time fixed effect and state fixed effect, my estimates become insignificant. But at least for Home Health Aides and nursing occupation, the direction become negative. This corresponds with Furtado and Ortega's argument that the measure of proportion of fall is particularly sensitive to nurse assistant staffing (2020), but their estimate may suffer from unobserved confounding.

Table 10: model with nursing home charateristics and state fixed effect

	Dependent variable:			
	% of Fall	% with daily pain	% with ADL decline	% with pressure ulcers
	(1)	(2)	(3)	(4)
Home Health Aides and nursing	-0.725	1.360	-1.660	-0.836
	(1.090)	(0.989)	(1.130)	(0.613)
Healthcare Support worker	0.199	0.225	0.320	-0.088
	(0.582)	(0.530)	(0.606)	(0.325)
Licensed Practical Nurse	0.659	-0.218	2.060	0.227
	(1.250)	(1.140)	(1.310)	(0.694)
Registered Nurse	4.270	0.450	4.550	0.358
	(2.990)	(2.720)	(3.120)	(1.680)
Observations	50,210	60,197	63,543	57,806
R^2	0.309	0.093	0.068	0.095
Adjusted R^2	0.308	0.092	0.067	0.094
F Statistic	350.000*** (df =	95.800*** (df =	72.300*** (df =	94.400*** (df =

	64; 50141)	64; 60128)	64; 63474)	64; 57737)
Note:				$^{*}p^{**}p^{***}p<0.01$

Overall, this analysis doesn't seem to suffer from the potential reverse causality issues given by the fixed effect model. In addition, the difference between Furtado and Ortega's analysis (2020) and mine is likely created by the difference in our immigrant estimates and the level of them. While my predictor is more specific with respect to occupation, their measure is more specific with respect to geography. Due to the limitation of the data, I can only obtain state level estimates of immigrants while they have the commuting zone level estimates. there are many possible differences that cause this paper to get different results. Further study shall be made to see if immigrant workers does have positive effect on the nursing home quality.

7. Conclusion

This paper aims at exploring the relationship between the share of immigrant workers in different nursing-related occupations and the quality of nursing homes. By combining and examining secondary data from IPUMS ACS data and LTC-Focus data across the states from 2012 to 2016, this paper used a longitudinal nursing home fixed-effects strategy to examine how the share of foreign-born workers affects quality in nursing homes, with the variation across states and over time.

Overall, three kinds of quality measurements are tested, and they yielded a mixed bag of results. Not many of the estimates are significant but in terms of outcome measure of quality, we can see if the share of foreign-born workers in Home Health aides and nursing-related occupations increases, we may also observe an increase in nursing home quality. But it's not the case for occupations like Licensed Practical

nurses and registered nurses. Results also show that for them an increase in foreign-born shares may decrease the nursing home quality. When it comes to the structural measure of quality, staffing hours, foreign-born shares don't seem to have a strong effect on them.

My results partly correspond with Furtado and Ortega's analysis in 2020: in terms of the outcome measure of quality contained in LTC-Focus data – Proportion of long-stay residents with daily pain, the proportion of low-risk long-stay residents with pressure ulcers, shares of foreign-born workers in Nursing and Home Health Aides, and Healthcare Support Workers are related with better quality in nursing homes. However, when using the most significant measure they proposed, the percentage of residents who recently fall, all predictors became insignificant and had a rather different sign. The possible reason for the inconsistency in results may be caused by the following reasons. First, my main variable, shares of foreign-born workers differ a lot. While Furtado and Ortega focus on the shares of the foreign-born population in a certain area, I'm more focused on the specific categories of occupations. Second, while we both controls for a similar nursing home characteristics, Furtado and Ortega's research mainly reports result without controlling for nursing home fixed effect (they replace it with state-level and community zone level fixed effect). The facility fixed effects account for any facility time-invariant unobservable (and observable) factors that affect the outcomes of interest. Thus, we should be cautious about accepting the inconsistent outcome.

This research has certain limitations. In terms of the empirical strategy, this paper

adopts the nursing home fixed effects model. However, nursing home fixed effects do not control for time-varying confounding and there could be issues of reverse causality. It is very possible that nursing homes in areas with staffing shortages or quality problems do more to recruit/attract more immigrants such that the hypothesized causal pathway is reversed. The lagged analysis helps to explore whether this is a problem and indicates that it probably is not, but it cannot completely solve the problem. Further studies could focus on finding the exogenous factor that affects foreign-born shares. For example, the difference in immigrant law related to nursing occupations across the state. In terms of the key variable, shares of foreign-born workers in nursing-related occupations, given the IPUMS data, the most precise estimates I can obtain are state-level estimations. Admittedly, this is not the most suitable level of estimates. My paper would produce a more robust result if estimates at a lower level could be obtained. For example, although LTC-Focus data provide abundant data of residents such as shares of different races, gender, and age, they do not provide a similar range of staffing data. The only data available are various nursing hours per day and the ratio of registered nurses divided by registered and licensed practical nurses. It would be better if their race and birthplace (indicating foreign-born or not) could be provided. In addition, the shares I calculate are the overall shares of the nursing-related occupations, including people working in the nursing home and other hospitals. Again, if I can obtain more accurate estimates, the result might be more obvious and relevant.

The mixed results in this paper may lead to a further question: What is exactly improved or harmed by the changing shares of foreign-born workers? Future analysis

exploring the mechanism of the effect might be useful for quantitative research to develop a more solid measure of the effect of foreign-born workers. For example, although staffing ratios are important in analyzing the quality, this paper doesn't find a strong relationship between them and the shares of foreign-born workers. Thus, one of the main hypothesized mechanisms of effect – that immigration helps to improve staffing ratios, which in turn are necessary for quality – is not supported by these results. In addition, while this paper shows that foreign-born workers may have a minor impact on the quality, the results are inconsistent with the previous studies. The negative results from this paper also suggest that having an increasing number of foreign-born workers in nursing-related occupations itself is not enough.

As the US healthcare industry already is experiencing recurring labor shortages, particularly in less-skilled occupations due to an insufficient supply of workers with the right educational backgrounds (Leutz 2004), the government should focus on providing more benefits for these workers and help them better integrated to the American Society. During the COVID-19 pandemic, Nursing homes that were understaffed may have been particularly badly hit (Harrington et al. 2020) My analysis suggests that simply having more foreign-born workers in the state, or immigrants in Home Health Aides occupations may not be enough; nursing homes still must attract and retain them. Further studies shall be conducted to understand the mechanism of how the share of foreign-born workers in nursing-related occupations affects nursing home quality in the United States. I believe there should be an effective way for society to decrease the threats of viruses posed upon those most vulnerable elders in the US, but we need more

focus on this issue.

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