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RESEARCH ARTICLE

Paying for the view? How nursing home prices affect certified staffing ratios

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Abstract

Many countries limit public and private reimbursement for nursing care costs for social or financial reasons. Still, quality varies across nursing homes. We explore the causal link between case-mix adjusted nurse staffing ratios as an indicator of care quality and different price components in Swiss nursing homes. The Swiss reimbursement system limits and subsidizes the care price at the cantonal level, which implicitly limits staffing ratios, while the residents cover the nursing home-specific lodging price privately. To estimate causal effects, we exploit (i) the exogeneity of the Swiss care price regulation, (ii) nursing-home fixed effects estimations and (iii) instrumental variables for the lodging price. Our estimates show a positive impact of prices on certified staffing ratios. We find that a 10% increase in care prices increases certified staffing ratios by 3–4%. A comparable 10% increase in lodging prices raises certified staffing ratios by 1.5–10% (depending on the model). Our findings highlight that price limits for nursing care impose a limit on staffing ratios. Furthermore, our results indicate that providers circumvent price limits by increasing lodging prices that are privately covered. Thus, this cost shifting implicitly shifts the financial burden to the residents.

KEYWORDS

care quality, long-term care, nursing home, prices, staffing ratios

1 | INTRODUCTION

Demographic change and population aging will lead to a steep increase in the demand for long-term care (LTC) over the next decades. Additionally, informal care giving is likely to decline due to the increased labor force participation of women, which boosts demand for LTC workers even further (Colombo et al., 2011). Consequently, LTC systems worldwide face the challenge of how to deliver and finance high-quality LTC services (Spasova et al., 2018). This paper highlights the case of Switzerland, one of the richest Organisation for Economic Co-operation and Development (OECD) countries with a gross domestic product (GDP) per capita of more than US\$73,000 (OECD, 2021a). Spending on LTC amounts to 2.4% of the GDP (OECD, 2021b). Moreover, Switzerland is among the OECD countries with the highest supply of, as well as demand for, nursing home care. In 2016, 153,301 patients were cared for in 1552 nursing homes, which is equivalent to 10.1% of the Swiss population aged 65 years or older (Federal Office of Public Health (FOPH) (2021); Federal Statistical Office, 2018). Swiss nursing homes have high nurse staffing ratios (0.5 full-time equivalent nurses per resident) compared to, for example, the US with 0.4 (Dyer

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et al., 2019). Since LTC is highly labor-intensive and the population is aging rapidly, the demand for LTC workers will increase steadily in most OECD countries (Colombo et al., 2011). As elsewhere, the Swiss system is struggling to address rising costs and expected staff shortages (Cosandey & Kienast, 2016). To keep rising costs under control, the Swiss parliament passed a law in 2008 to implement a new financing system that became effective in January 2011 and regulates payments of the obligatory health insurance including capped private contributions for nursing care at a fixed level across cantons (The Federal Council, 2021b).

In this paper, we address the interrelation between financing nursing home care, certified staffing levels, and public-private cost-sharing. We analyze (i) whether higher prices lead to better care quality, and (ii) whether price limits on nursing care increase privately borne nursing home costs. Since certified staffing ratios are shown to be a good indicator of care quality (Campbell et al., 2000; Konetzka et al., 2008; Lin, 2014), higher prices may increase care quality thanks to higher nurse staffing ratios. We follow Hackmann (2019) and Lin (2014) by measuring care quality by case-mix weighted certified nurse staffing ratios, that is, the number of certified nurses divided by the number of residents.

To study the relationship between prices and certified staffing ratios, we exploit a unique feature of the Swiss LTC system that allows us to draw causal inferences. The nursing home providers are reimbursed separately for nursing care and for accommodation and services. In the 12 cantons we analyze, providers face canton-wide fixed prices for nursing care (care price), while they set individual prices for accommodation and services (lodging price). This canton-specific regulation enables us to analyze (i) the causal effect of care prices on certified staffing ratios, and (ii) potential cost-shifting to the residents by investigating the extent to which lodging prices affect certified staffing ratios. Residents fully cover the lodging price, but only pay a capped contribution to nursing care. Hence, subsidizing public with private payments would raise equity concerns. Anecdotal evidence indicates that for some nursing homes lodging prices lie above the actual costs for lodging, thus, they may use the excess amount to finance care costs (Cosandey & Kienast, 2016; Federal Statistical Office, 2015). Newspaper articles suggest that around 50% of nursing homes substitute their care costs with reimbursement for lodging (Erny & Weber, 2018 (SRF)). When explaining the relation between the lodging price and nurse-to-resident ratios, we deal with potential endogeneity concerns in our linear regressions, for example, when both are driven by unobserved demand characteristics.

We follow two approaches. First, we present regressions including nursing home fixed effects that control for time-invariant unobservable characteristics. Second, we draw from Forder and Allan (2014) as well as Herr and Hottenrott (2016) and apply a two-stage least squares approach and construct an instrumental variable for the lodging price.

The direction of the effect of prices on certified staffing ratios is a priori uncertain. On the one hand, higher prices may increase quality, as it is possible to employ more registered nurses. On the other hand, nursing homes can be classified as experience goods and higher prices may be used to signal high quality to potential residents irrespective of the actual quality level (Plassmann et al., 2008), especially in the Swiss case, where care prices are capped and lodging prices should not be used to increase care staffing.

The results are also relevant for other countries with financially strained LTC systems. For example, German nursing homes are also required to set separate prices for nursing care and for accommodation and services, while this separation is only enforced ex-ante. However, the issues of implicit quality limits and equity concerns remain. In contrast, US nursing homes only charge a single price to cover all costs and may set prices for private payers freely, while public Medicare and Medicaid contributions are tightly regulated with different regulations by state and population group (Feder et al., 2000). Hence, while regulations may differ across countries, the aim of the regulation is always to restrict public or private expenditures for nursing homes.

Fixed care prices lead to the question of how nursing homes cover higher costs if they want to employ more registered nurses. From a competition theory point of view, a fixed price combined with unobservable differences in quality may lead to a convergence in the quality across nursing homes. If asymmetric information is relevant, this convergence may result in decreased certified staffing ratios, even lower than the residents would be willing to pay for. This adverse selection problem was first identified in the market for used cars by Akerlof (1970), but adverse selection also occurs in other markets such as, for example, the market for health or life insurance (Dionne et al., 2000) or financial markets (Philippon & Skreta, 2012). To prevent adverse selection, nursing homes may use higher lodging prices either as a signal or as an actual subsidy to deliver higher quality. Although such cross-subsidization is unlawful, it is frequently reported (INFRAS et al., 2018).

While price regulation is effective in limiting public expenditures, the issue of securing a high quality of care by maintaining an adequate level of certified staffing remains (Spasova et al., 2018). Reports about insufficient care in nursing homes are common (e.g., Tscharnke (2009)). A central aspect of such reports and in scientific debates on care quality are nurse-to-resident staffing ratios (see e.g., Chen and Grabowski (2015) or Tong (2011), on US nursing homes). Although there are several attempts to measure outcome quality objectively, this remains difficult in the LTC context due to a lack of objective and comparable data (Castle & Ferguson, 2010).

The literature mostly points to a positive relationship between care prices and care quality. Looking at Medicaid reimbursement rates in the US both Cohen and Spector (1996) and Grabowski (2001) find a positive impact of prices on staffing ratios. Similarly, a recent study by Hackmann (2019), which uses a structural model of the nursing home industry in the US state of Pennsylvania, shows that a 10% increase in the Medicaid reimbursement rate leads to an 8.7% increase in registered nurse staffing ratios. Moreover, it shows that this would also increase overall welfare, despite the higher costs. In the German context, Reichert and Stroka (2018) find that some medical quality indicators are positively correlated with prices while others do not show any significant relation. Like-wise, Forder and Allan (2014) find that competition reduces prices, which in turn pushes down quality in English nursing homes. Herr and Hottenrott (2016) provide causal evidence on the direct link between higher prices and better quality of care in German nursing homes.

Our study contributes to the literature in two ways. First, it exploits the unique Swiss reimbursement system to measure the impact of care prices on quality of care and also addresses endogeneity concerns present in previous studies. Second, it uses case-mix weighted certified staffing ratios to measure care quality, which allows comparability between findings from different countries. Our results show that a 10% increase in care prices increases the number of registered nurses per resident by 3.4–4%. Furthermore, a 10% increase in the lodging price raises the certified staffing ratio by 1.5% in the fixed-effects model and by 10% in the two-stage least squares estimation, which is in line with the cross-subsidization theory. Hence, higher lodging prices may serve as a signal of higher quality since care prices do not vary within a canton.

2 | METHODS

2.1 | Literature on quality of care and certified nurse staffing ratios

The measurement of quality of care remains a debated topic. Donabedian's model classifies quality of care by distinguishing between structural, process, and outcome parameters (Donabedian, 1988). Structural parameters refer to organizational factors that define the health care system. Nurse staffing is an important structural parameter for care quality that has been shown to have a direct and indirect impact on different care outcomes (Campbell et al., 2000; Konetzka et al., 2008; Lin, 2014). Among others, these are improved physical functioning, less antibiotic use, fewer deficiencies, less weight loss, less dehydration, and even fewer hospital visits and lower mortality rates (Friedrich & Hackmann, 2021; Kaiser Family Foundation (KFF), 2018; Kimmey & Stearns, 2015; Lin, 2014). Nevertheless, nationwide nurse staffing standards are lacking in many countries and existing standards are difficult to compare due to differences in measurement and the vagueness of standards (Harrington et al., 2012).

Swiss cantons implemented different staffing requirements or minimum educational requirements for LTC workers. For example, minimum staffing ratios exist for all nursing homes and most cantons define quantitative as well as qualitative minimum staffing ratios that require a specific share of qualified personnel. However, staffing requirements are not always binding in the short run and adherence is not publicly reported (Cosandey & Kienast, 2016). Furthermore, the specified staffing requirements are typically considered to be insufficient and to provide a lower limit for quality (Harrington et al., 2012; Mueller et al., 2006). Indeed, inadequate staffing ratios are an important reason for quality shortfalls in nursing homes (Harrington et al., 2016, 2020). We follow Hackmann (2019) and Lin (2014) and measure care quality by case-mix weighted certified staffing ratios. The case-mix weight is necessary since individuals with a higher care level require more care than individuals with a lower care level. This is especially the case for qualified staff: A recent study documenting the workflow and measuring the necessary time and qualification requirements in nursing homes in Germany shows that the optimal certified nurse-to-resident level increases continuously with the level of care needed while the pattern is less clear for nursing assistants (Rothgang, 2020).

2.2 | Institutional setting

The organization of LTC in Switzerland largely falls under the responsibility of the 26 cantons, which enter contracts with nursing homes regarding the amount of care provided, reimbursement, and operating conditions directly or they delegate this duty to the municipalities. In general, reimbursement for nursing homes consists of three components: The care price, the price for accommodation and services, and subsidies. However, the amount of reimbursement of nursing care costs varies across Swiss cantons and for some cantons also across nursing homes. While many cantons set predetermined prices for the reimbursement of nursing care that apply to all nursing homes within the canton – so-called “norm costs” – or define

canton-wide maximum reimbursement levels, some cantons have community-based or provider-specific regulations that vary across nursing homes within a canton (for an overview of the financing schemes, see Table A1 in the appendix). In this study, we only include nursing homes from the 14 cantons with fixed prices or maximum reimbursement rates. Among these cantons, only two cantons define a maximum reimbursement per level of care, which we exclude in a robustness check. In addition, in each canton the care price depends on the resident's intensity of care. Thus, in our sample, the care price is exogenous for the single nursing homes and only varies by the resident's care level. Upon entering a nursing home, a patient's LTC needs are assessed on a scale of 0–12 care levels based on a detailed clarification of needs process where each care level represents 20 min of daily care needs. The patient or their relatives and the nursing staff answer questions on the patient's physical and cognitive abilities and limitations, well-being, nutrition, continence, pain, plus medication and therapies. The needs assessment is repeated regularly to (re-)assess the patient's level of care (further information about the process is provided in Appendix A1). The financing of nursing care is split between the obligatory health insurance, the dependent person, and the cantons. Based on the assigned care level, the insurance pays a contribution to the nursing home for the provision of nursing care of 9 CHF (1 CHF equals approximately US \$1.1 on June 21, 2021) per day and level of care, that is, the insurance contribution is capped at 108 CHF per day for the 12th care level (9 CHF \times 12). The private contributions to nursing care are limited at the federal level and may not exceed 20% of the maximal reimbursement by the insurance. Hence, the patient's contribution is capped at 21.60 CHF (108 CHF \times 0.2) per day for all cantons. Any remaining nursing care costs up to the norm costs or maximum reimbursement levels are financed by the cantons (Cosandey & Kienast, 2016). Table 1 gives an example of how the care price is split up.

The lodging price is set freely by each nursing home and is borne completely by the resident. Nursing homes also receive subsidies, for example, to cover losses or to finance new buildings or equipment. Subsidies represent a minor part of the total reimbursement and are paid by the municipalities, the cantons, or foundations.

While the regulation of nursing home prices is effective in limiting the cantonal expenditures for nursing home care, the fixed reimbursements for nursing care leave little room for competition based on care quality since the reimbursement levels are targeted at covering costs based on past cost accounting. Hence, nursing homes may have an incentive to use lodging prices to increase staffing ratios. Besides prices (certified) staffing ratios are the only other quality-related measures that are both comparable and available (Cosandey & Kienast, 2016).¹ Thus, we assume that nursing homes use additional revenue through cross-subsidization to hire additional certified staff and signal higher quality. Although subsidizing nursing care through higher lodging prices is illegal, it is expected to be common practice in Switzerland (INFRAS et al., 2018). Cross-subsidization, however, raises equity concerns since this price component is fully borne by the resident.

TABLE 1 Example of financing mix for nursing care (canton Thurgau in 2013)

Level of care	Norm costs	Health insurance	Resident	Canton/municipality
1	14.80	9.00	5.80	0.00
2	38.10	18.00	20.10	0.00
3	48.60	27.00	21.60	0.00
4	70.30	36.00	21.60	12.70
5	97.90	45.00	21.60	31.30
6	115.60	54.00	21.60	40.00
7	137.00	63.00	21.60	52.40
8	150.00	72.00	21.60	56.40
9	175.70	81.00	21.60	73.10
10	183.10	90.00	21.60	71.50
11	206.40	99.00	21.60	85.80
12	277.40	108.00	21.60	147.80

Note: Prices are given in Swiss francs per care day. The norm costs represent the canton-wide fixed care price and vary by canton and year (2012–2017). The part paid by the health insurance is fixed for all cantons across Switzerland and the amount paid by the resident is capped at 21.60 CHF. The norm costs shown here serve as an example (canton Thurgau). The cantons may delegate the financing obligations to the municipalities.

Source: Alters-und Pflegeheim National (2013) showing taxes for the year 2013.

2.3 | Data

We base the analysis on administrative data published yearly by the Swiss Federal Office of Public Health including key performance figures and characteristics of all Swiss nursing homes from 2012 to 2017 (FOPH, 2021).² Our dependent variable is the case-mix weighted number of registered nurses per 1000 care days (certified staffing ratios). We account for the residents' average case-mix to control for the fact that the medical needs and skilled nursing needs increase with the resident's care level. Since the data comprises the average care level of each nursing home, we define the case-mix weight as follows: We divide the average cantonal care level by the average care level of the nursing home within this canton. This accounts for the fact that nursing homes with a care level below the canton average require fewer registered nurses to provide the same quality level and vice versa.

Certified staffing ratios of nursing home i in canton c and year t are given by:

$$\text{Certified staffing ratio}_{it} = \frac{\# \text{ of registered nurses}_{it}}{1,000 \text{ care days}} \cdot \frac{\text{average care level}_{ct}}{\text{care level}_{it}}$$

As explanatory variables of interest, we analyze the different price components. We consider the lodging price, the care price, and revenues from subsidies, where subsidies may involve all kinds of financial support from the public sector or private organizations. We compute revenues for accommodation and services by the residual between the two former revenue components and total revenues. Analogous to the certified staffing ratio, we weight the care price by the nursing home's case-mix. All prices are measured as prices per care day in Swiss Francs.

We control for nursing home size by using the number of beds including long-term, short-term, and acute care beds. Moreover, we use an indicator of whether a nursing home is a private for-profit home to allow for potential correlation between the certified staffing ratio and ownership type. Comodore et al. (2009) find in their meta study that, on average, non-profit nursing homes provide higher quality than for-profit nursing homes. Furthermore, Grabowski et al. (2013) identify a positive causal effect of non-profit ownership on quality using instrumental variable estimations.³ Here, state-run and non-profit nursing homes serve as the reference group. In addition, we control for the cantonal price level (GDP per capita), the cantonal age structure (share of population aged 65 and above) and the cantonal unemployment rate to account for changes in buying power and needs.

Since our estimation strategy relies on exogenously set nursing prices, we select the cantons that have limited their care prices by defining fixed norm costs (10 cantons) or by setting an upper bound (2 cantons; Cosandey & Kienast, 2016; INFRAS et al., 2018). Thus, care prices by level of care intensity are predetermined for all nursing homes in our sample. For our regression analysis, we exclude the two very small cantons with less than 10 nursing homes. This results in 5668 nursing home-year observations. Of these, we exclude 34 observations without any beds for LTC. To further reduce the potential influence of outliers, we only keep observations where our main variables (number of registered nurses, price components, number of beds) lie within the first and the 99th percentile excluding 367 more observations. Lastly, since the construction of our instrumental variable relies on the existence of similar nursing homes, we only include nursing homes with comparable competitors within a specified region (details below). This leads to our final sample of 4390 observations from 925 nursing homes over 6 years.

2.4 | Descriptive statistics

Table 2 shows the average values and standard deviations of our main variables for the whole sample as well as by canton. The average nursing home has around 51 beds and private for-profit owners run 33% of all nursing homes. Swiss nursing homes employ, on average, slightly less than one registered nurse per 1000 care days or 0.35 (0.97/1000 x 365) registered nurses per patient. All numbers denote case-mix weighted full-time equivalents. The average number of registered nurses per 1000 care days varies from 0.67 in Aargau to 1.48 in Jura with standard deviations between 0.21 and 0.35, implying considerable quality differences across and within cantons.

The average cantonal care price varies between 84.13 and 126.33 CHF per care day. In comparison, the average lodging price varies between 125.85 and 205.31 CHF across cantons and resulting revenues account for the largest part of the total reimbursements in all cantons. Subsidies only account for a minor part of revenues (1.42 to 8.82 CHF per care day, on average).

Figure 1 shows the variation in prices and certified staffing ratios at the nursing-home level over time. Specifically, it displays the cantonal averages of the yearly variation in certified staffing ratios and the price components within nursing homes,

TABLE 2 Descriptive statistics by canton (mean values, SD given in parentheses)

	All	AG	AR	BE	BL	BS	GR	JU	SG	SO	TG	VD	VS
Registered nurses per 1000 care days	0.97 (0.34)	1.04 (0.33)	0.67 (0.22)	1.09 (0.34)	1.06 (0.23)	1.22 (0.29)	1.01 (0.35)	1.48 (0.27)	0.74 (0.21)	1.07 (0.35)	0.91 (0.22)	0.74 (0.22)	0.94 (0.23)
Daily prices (in CHF)													
Nursing care	107.71 (17.87)	95.83 (10.61)	84.13 (11.38)	113.43 (16.82)	97.25 (5.79)	109.09 (12.78)	106.21 (12.20)	115.42 (14.42)	89.43 (7.82)	104.06 (13.84)	98.86 (9.31)	122.42 (15.37)	126.33 (3.64)
Lodging	157.09 (30.30)	162.45 (29.37)	125.85 (32.72)	162.76 (27.86)	205.31 (14.33)	193.21 (39.86)	146.45 (26.23)	151.41 (14.56)	144.48 (24.78)	162.97 (29.22)	146.91 (22.32)	160.02 (29.48)	127.80 (13.42)
Subsidies	4.66 (12.62)	2.65 (11.38)	8.54 (17.94)	3.22 (11.17)	1.42 (3.65)	7.02 (20.60)	9.09 (19.20)	9.82 (12.02)	4.43 (10.95)	5.57 (17.59)	2.10 (6.97)	7.30 (11.99)	6.54 (6.29)
Number of beds	50.94 (29.96)	56.11 (31.02)	32.00 (12.18)	45.25 (30.50)	105.76 (27.45)	75.02 (27.74)	47.21 (22.54)	48.89 (8.37)	55.28 (27.22)	56.83 (21.63)	48.37 (25.51)	47.15 (28.99)	68.69 (33.75)
Private nursing homes (in %)	33.21 (47.10)	33.40 (47.21)	43.02 (49.80)	44.16 (49.67)	0.00 (0.00)	4.76 (21.38)	4.40 (20.55)	0.00 (0.00)	16.89 (37.50)	25.99 (43.96)	61.00 (48.90)	43.29 (49.59)	1.03 (10.13)
Population 65+ (in %)	18.47 (1.62)	16.76 (0.40)	18.65 (0.37)	20.01 (0.37)	20.97 (0.40)	20.29 (0.23)	19.84 (0.73)	19.68 (0.62)	17.33 (0.44)	18.81 (0.36)	16.57 (0.47)	16.23 (0.12)	18.56 (0.53)
Unemployment Rate (in %)	2.87 (0.92)	2.99 (0.17)	1.76 (0.13)	2.45 (0.23)	2.77 (0.10)	3.74 (0.10)	1.67 (0.08)	3.95 (0.56)	2.39 (0.08)	2.67 (0.18)	2.41 (0.14)	4.79 (0.18)	3.93 (0.30)
GDP per capita (in 1,000 CHF)	75.19 (19.60)	64.31 (0.19)	57.83 (1.00)	77.98 (0.58)	71.17 (0.86)	180.73 (9.93)	72.16 (0.74)	65.38 (1.31)	74.84 (0.58)	67.55 (0.42)	62.04 (0.39)	72.00 (1.47)	54.46 (0.15)
Urbanity	0.09 (0.28)	0.00 (0.00)	0.00 (0.00)	0.11 (0.32)	0.00 (0.00)	0.99 (0.09)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.14 (0.34)	0.00 (0.00)
Number of nursing homes per year	731.83	80.04	14.44	265.51	5.62	21.29	41.67	3.42	98.70	38.06	33.36	99.37	32.40
Observations	4,390	479	86	1592	29	126	250	19	592	227	200	596	194

Note: The number of registered nurses and care prices are weighted by case-mix. Means and standard deviations (in brackets) are generated from the pooled cross-section (years 2012–2017). Cantons: AG=Aargau, AR: Appenzell Auserrhoden, BE: Bern, BL: Basel-Landschaft, BS: Basel-Stadt, GR: Grisons, JU: Jura, SG: St. Gallen, SO: Solothurn, TG: Thurgau, VD: Vaud, VS: Valais.

Source: FOPH 2021, 2012–2017, own calculations.

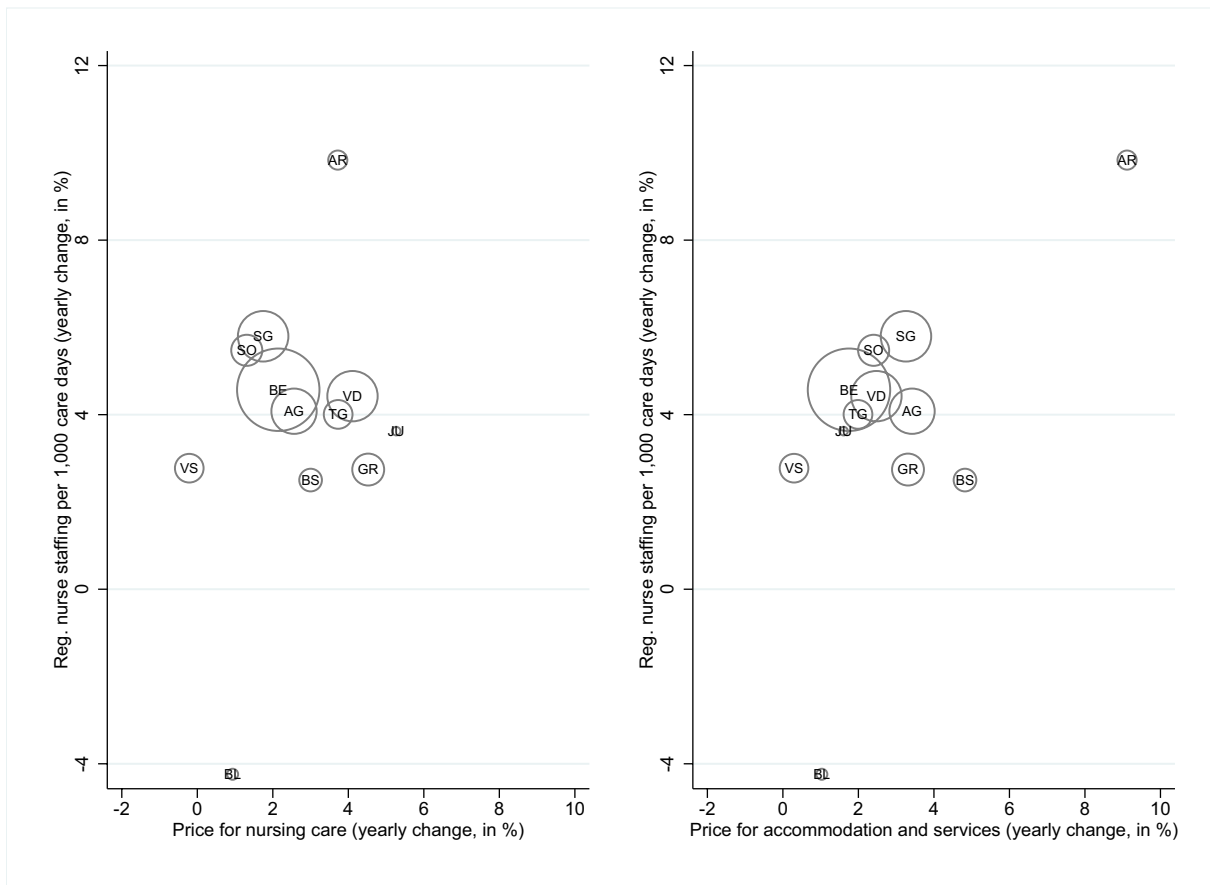


FIGURE 1 Cantonal averages of the yearly variation in price components and registered staffing ratios across nursing homes. The number of registered nurses and care prices are weighted by case-mix. Prices are deflated using consumer price indices (Federal Statistical Office (2021), base year 2012). The size of the circles reflects the underlying number of nursing homes in the respective canton. Cantons: AG=Aargau, AR: Appenzell Ausserrhoden, BE: Bern, BL: Basel-Landschaft, BS: Basel-Stadt, GR: Grisons, JU: Jura, SG: St. Gallen, SO: Solothurn, TG: Thurgau, VD: Vaud, VS: Valais. *Source:* FOPH (2021), years 2012–2017, own calculations [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

where the size of the circles reflects the underlying number of nursing homes in the canton. Care and lodging prices increase by 2.67% per year, while staffing ratios increase, on average, by 4.49% per year.

2.5 | Estimation strategy

The empirical strategy exploits the geographical and time variation of care prices, that is, our identifying variation stems from price variation across cantons over time. As a first step, we use ordinary least squares (OLS) estimation to regress certified staffing ratios in nursing home i in year t on the different price components and other nursing home-specific control variables X_{it} :

$$\text{Certified staffing ratios}_{it} = \beta_0 + \beta_1 \ln(P_{it}^{NC}) + \beta_2 \ln(P_{it}^{AS}) + \beta_3 \ln(P_{it}^S) + X_{it}\alpha + R_c\psi + \gamma_t + \delta_c + u_{it} \quad (1)$$

P_{it}^{NC} denotes the case-mix adjusted daily care price, P_{it}^{AS} refers to the daily lodging price paid for accommodation and services, and P_{it}^S denotes subsidies. The log of daily prices is used to adjust for outliers. X_{it} controls for nursing-home characteristics like the ownership type and the size of the nursing home. R_c controls for changes in the cantonal price level and income by including the GDP per capita and the cantonal unemployment rate. We also control for changes in cantonal demographics using the share of the population aged 65 and above. γ_t captures year fixed effects, δ_c refers to canton fixed effects, and u_{it} denotes the error term. While year fixed effects control for changes in the overall economic situation, the canton fixed effects capture potential differences across cantons, such as demographics or the need assessment system.

To interpret the coefficients of the price components as causal effects, the variables must be exogenous with respect to staffing ratios. For the care price, exogeneity follows as we limit our sample to cantons that assign fixed prices per care level. Exogeneity further implies that the change in the regulated price is unrelated to other factors that might drive nursing-home specific staffing levels, conditional on the covariates and fixed effects included. We are not aware about any changes in the pricing regulations, staffing level regulations or definitions of the individuals' care needs between 2012 and 2017, especially not in combination with changes in prices. Our data also show that, within cantons, changes in lodging prices are not correlated with changes in care prices (controlling for covariates and fixed effects, regression results upon request). Subsidies are small on average and are usually paid irregularly to help nursing homes with large investments, for example, in new buildings, or to reduce an overall deficit. We think that potential endogeneity concerns are negligible. Finally, the third price component, the lodging price, may be endogenous due to unobserved demand factors that influence both, lodging prices and staffing ratios positively, such as preferences for high quality and education. Furthermore, since cross subsidizing is officially illegal, some nursing homes do not exploit the resident's willingness to pay higher lodging prices to finance their care costs although they would if it was legal, while others do. Both issues lead to a downward bias of the OLS estimates.

Therefore, we first exploit the panel structure of our data and run nursing home specific fixed-effects (FE) regressions. With the FE approach, we exploit within-nursing home variation in lodging prices and get closer to the average treatment effect of the treated (what happened to staffing ratios if there was no cross-subsidization). The fixed effects take out unobserved demand and supply characteristics that vary across nursing homes within the canton, but do not change over time, for example, local willingness to pay, long-term care needs or the nursing home's willingness to subsidize care with private contributions. Additionally, we employ a two-stage least squares estimation approach (2SLS). As an instrumental variable, we use the average lodging price of comparable nursing homes that lie within the same canton, but outside a 15-min driving radius (exclusion radius). The idea stems from the industrial organization literature, where prices are instrumented with common cost-shifters (such as prices of ingredients to the final product or prices from related products in other markets) to eliminate any unobserved demand effects (Hausman, 1996; Nevo, 2000). We explain the idea in more detail below. Our first-stage estimation is given by

$$\ln(P_{it}^{AS}) = \alpha_0 + \alpha_1 \ln(\overline{P_{*t}^{AS}}) + \alpha_2 \ln(P_{it}^{NC}) + \alpha_3 \ln(P_{it}^S) + X_{it}\beta + R_c\psi + \gamma_t + \delta_c + v_{it} \quad (2)$$

where $\overline{P_{*t}^{AS}}$ denotes the average lodging price of the similar nursing homes in the same canton that are assigned to nursing home i and v_{it} denotes the error term. Furthermore, all remaining variables from the second-stage regression are included in regression (2). For identification, we need to assume that $cov(\overline{P_{*t}^{AS}}, v_{it}) = 0$, which means that the instrumented price must not be correlated with the error term in the second stage and must not have a direct effect on nurse staffing other than through the lodging price. The instrumental variable is only relevant if $cov(\overline{P_{*t}^{AS}}, price_{it}) \neq 0$, that is, α_1 must be significantly different from zero.

2.5.1 | Instrumental variable

The nursing home market is a very local market and most nursing home residents choose a nursing home close to their original home (Schmitz & Stroka, 2020). Nursing homes beyond the 15-min driving radius are unlikely to be direct competitors and do not impact either the price setting or the quality choice of the respective nursing home. The exclusion radius is reduced to 5 min within the five cities in our sample since nearly all nursing homes are reached in 15 min within cities. By doing this, we exclude nursing homes that compete for the same care-dependent residents. Instead, we use similar nursing homes with respect to (i) size (the number of beds does not differ by more than 10) to capture potential economies of scale, (ii) ownership structure (for-profit vs. not for-profit) to capture intrinsic motivation to provide high quality or to exploit the residents' willingness to pay, and (iii) location (urban vs. rural) to capture location differences in rents. The average lodging price of these similar but non-competing nursing homes serves as our lodging price instrument.

Within-canton variation in the lodging price (which is not regulated and can be freely set by the nursing homes) stems from variation in local prices for housing and amenities. By using lodging prices of similar, but not close nursing homes, we eliminate demand shocks (e.g., differences in care needs due to differences in education or family composition) as well as quality preferences that might play a role for the individual's willingness to pay. We rely on the distance as the most important selection criterion that overrules preferences for quality beyond the 15 min threshold (Schmitz & Stroka, 2020). Calculating the average lodging price of the comparable nursing homes for each nursing home separately and inserting canton and time fixed effects, we exploit within-canton variation in lodging prices across the groups of comparable nursing homes (e.g., bigger nursing homes

may suffer more from increases in rents). The average lodging price may also vary due to local competition for certified nurses (but outside the exclusion radius), which may lead to pressure to make working environments more attractive and therefore to increase lodging prices given that the care price is capped.

Assuming that our assumptions hold, our estimated local average treatment effect presents the causal relation of lodging prices on staffing ratios identified by the compliers, that is, by nursing homes that adapt their lodging prices due to higher costs and invest more into staffing although they would not do it when costs were lower. The increased competitive pressure pushes the complying nursing homes to start cross-subsidizing similar to their non-complying competitors to be able to provide an attractive and comfortable working environment for the care staff and to offer more amenities to attract the more educated and well-off residents who can afford the higher lodging prices.

We test the sensitivity of our assumptions regarding the exclusion radius as well as the “similarity” of nursing homes in different robustness checks in Section 3 below the main results. By exploiting both, the FE and IV approach, we get a lower-bound estimate for the effect of lodging care prices when using the within nursing home variation (short-term adjustments) and an upper bound when estimating the IV model (assuming that all nursing homes would use private contributions to subsidize care despite the unlawfulness). Still, differences between the two models might also be due to remaining endogeneity in the fixed effects model. However, the estimated coefficients show similar signs and significance and only vary in magnitude.

3 | RESULTS

Table 3 presents our main estimation results. The first column shows the OLS results for our dependent variable, the case-mix weighted number of registered nurses per 1000 care days. In this model, a 1% increase in nursing care prices (which represents an increase of approximately 1 CHF per day or 30 CHF per month) is associated with 0.004 additional registered nurses per 1000 care days. While the effect seems small, it becomes more tangible with the following example: a 10% (or 11 CHF) increase in the nursing care price for an average-sized nursing home with 51 beds would imply 0.7 (or 4%) additional registered nurses ($0,400 \cdot \ln(1.1)(365 \text{ days} \cdot 51 \text{ beds}/1,000 \text{ days})$). Given that average care prices vary between 84 CHF and 126 CHF per day across the included cantons, considering a price variation of 10% seems plausible.

As argued above, the number of registered nurses should, by law, be independent of the lodging price. Still, it correlates significantly with the number of registered nurses. In contrast and as expected, subsidies correlate little, but are still statistically significant. Furthermore, the OLS results show that private and bigger nursing homes employ fewer registered nurses per 1000 care days. While these differences may also indicate quality differences, economies of scale may explain the latter.

In the second column, we exploit the within-nursing home variation adding nursing home fixed effects to the OLS regression. In comparison to the OLS estimates, the coefficients in the FE model are slightly smaller but remain qualitatively the same. Revisiting the example of a 10% increase in the care price, the main effect corresponds to 0.6 (or 3%) additional nurses ($0.312 \cdot \ln(1.1)(365 \text{ days} \cdot 51 \text{ beds}/1,000 \text{ days})$) in an average-sized nursing home.

In the third column, we show the IV estimates where we instrument the lodging price with the average lodging price of comparable nursing homes that lie within the same canton, but outside of our preferred exclusion radius of 15 min. The effect of care prices on staffing ratios is 0.334, which is comparable to the OLS and FE results. With respect to the lodging price, the IV model shows a significant effect of 1.044 on certified staffing ratios, which is larger than the OLS and FE estimates. As postulated, the difference is due to the fact that the FE estimates incorporate smaller short-run adaptations within nursing homes over time, while the IV estimates reflect larger strategical adjustments of nursing homes that subsidize qualified staffing by charging higher lodging prices (across nursing homes within cantons). Revisiting the example of a 10% price increase in the IV model, the main effect corresponds to 1.85 additional nurses ($1.044 \cdot \ln(1.1)(365 \text{ days} \cdot 51 \text{ beds}/1,000 \text{ days})$) in an average-sized nursing home. Hence, a 10% increase in the lodging price raises the number of registered nurses per resident by 10%. If the lodging price increases by a comparable absolute amount to the 10% increase in the nursing care prices (10.77 CHF), the number of registered nurses per resident would go up by 7.1%. This effect is smaller than a 10% increase but still twice as large as the effect of a respective increase in care prices. Overall, all models show a positive relation between lodging prices and staffing ratios.

3.1 | Robustness of the results

First, in Table 4, we vary the exclusion radius of our instrumental variable between 5, 15 and 25 min. To assess the strength of our instruments, we present the results of the first-stage regression at the bottom of Table 4. Our main IV specification (15-min exclusion radius) is reproduced in column 2, while columns 1 and 3 show the results for exclusion radii of 5 and 25 min,

TABLE 3 Regression results for the number of registered nurses per 1000 care days across different models

	(1)	(2)	(3)
	OLS	FE	IV
Log daily price for			
Nursing care	0.400*** (0.067)	0.312*** (0.046)	0.334*** (0.075)
Lodging	0.315*** (0.046)	0.158*** (0.041)	1.044*** (0.318)
Subsidies	0.025*** (0.005)	0.018*** (0.048*** (0.010)	0.048*** (0.010)
Private	-0.090*** (0.021)		-0.128*** (0.019)
Number of beds	-0.090*** (0.016)	-0.094* (0.040)	-0.094*** (0.010)
Population above 65	-0.025 (0.029)	-0.012 (0.037)	-0.025 (0.026)
Unemployment rate	0.098*** (0.032)	0.078*** (0.028)	0.146*** (0.035)
GDP	-0.003 (0.003)	-0.002 (0.003)	-0.004 (0.002)
Observations	4,390	4,284	4,390
F-statistic of excluded instruments			12.87

Note: Year fixed effects are included in all specifications and canton fixed effects are included in the OLS and IV regression. Reference groups: Non-private nursing homes. The lodging price is instrumented using nursing homes within the same canton that are most similar in terms of beds (± 10 beds), ownership type, and urbanity. Registered nurses and care prices are weighted by case-mix. The FE sample is slightly smaller since, by construction, it only includes nursing homes that are observed at least for 2 years. The results for the OLS and IV regression remain nearly identical, if we use the FE sample instead (results available upon request). Standard errors are clustered at the canton-year level in the OLS and IV regression, and at the canton level in the FE regression.

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

Source: FOPH (2021), own calculations.

respectively. Across all models, the first-stage coefficient of our instrumental variable varies between 0.134 and 0.243 and is always significantly different from zero. The corresponding F-statistic is above 15 for an exclusion radius of 5 min, above 10 in our main model, but below 10 for an even larger radius indicating that an increasing exclusion radius decreases the relevance of our instrument. This seems plausible since closer nursing homes (but still outside the exclusion radius) may be more similar in further unobservable characteristics. Across the estimated IV-models, the effect of care prices on staffing varies slightly between 0.332 and 0.343 and is always significantly different from zero. With respect to the lodging price, the effect varies only slightly between 0.935 and 1.063 and is also always highly significant across the three radii. From the positive coefficients of the first and second stages, we conclude that increases in lodging prices in similar nursing homes do not lead, for example, to a lack of qualified staffing within the canton, which would put an implicit limit on the nursing homes' quality choices and subsidization.

Second, if we do not weigh the number of registered nurses per resident by case-mix, the coefficients for the care price double across models (results upon request). Persons with higher needs (and thus higher regulated care prices) require more qualified staffing. Not controlling for case-mix, we would overestimate the effect of higher care prices on staffing ratios. The coefficient for the lodging price increases by 30% in the OLS regression, while it is similar to before in the IV regression. Case-mix weighting does not affect our IV estimates for lodging prices, where we eliminate unobserved demand factors using instrumental variables.

Third, in Table 5, we vary the assumptions made for the choice of surrounding nursing homes that are used to construct the instrumental variable for the lodging price. In columns 1 and 2, we vary the level of similarity in terms of the number of

TABLE 4 IV-Regression results for the number of registered nurses per 1000 care days varied by exclusion radii

	(1)	(2)	(3)
	IV with different exclusion radii		
	5 min	15 min	25 min
Log daily price for			
Nursing care	0.343*** (0.067)	0.334*** (0.075)	0.332*** (0.078)
Lodging	0.935*** (0.278)	1.044*** (0.318)	1.063** (0.425)
Subsidies	0.045*** (0.009)	0.048*** (0.010)	0.049*** (0.013)
Private	-0.122*** (0.019)	-0.128*** (0.019)	-0.129*** (0.024)
Number of beds	-0.094*** (0.011)	-0.094*** (0.010)	-0.095*** (0.011)
Population 65+	-0.025 (0.025)	-0.025 (0.026)	-0.025 (0.026)
Unemployment rate	0.139*** (0.034)	0.146*** (0.035)	0.147*** (0.039)
GDP per capita	-0.004 (0.002)	-0.004 (0.002)	-0.004 (0.002)
Observations	4,390	4,390	4,390
First-stage estimates:			
Log lodging price in surr. nursing homes	0.243*** (0.059)	0.199*** (0.056)	0.134*** (0.053)
F-statistic exclusion restr.	16.77	12.87	6.31

Note: Canton and year fixed effects are included in all specifications. Reference groups: Non-private nursing homes. The lodging price is instrumented with the lodging price of other nursing homes outside a 5/15/25 min radius within the same canton that are similar in terms of beds (+/- 10 beds) ownership type and urbanity. Registered nurses and care prices are weighted by case-mix. Standard errors are clustered at the canton-year level.

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

Source: FOPH (2021), own calculations.

beds. In column 3, we do not control for ownership type. Lastly, we exclude the two cantons with maximum costs regulation. Although the coefficients vary slightly in magnitude, they remain qualitatively similar and are statistically significant across all these models.

4 | DISCUSSION

In this paper, we analyze the relation between certified staffing ratios and the pricing of nursing homes. In doing so, we examine whether nursing homes bypass limited reimbursement rates for nursing care by increasing privately paid lodging prices. To address endogeneity concerns present in previous studies, we exploit the canton-specific fixed care price along with the strict separation of cost components in the Swiss LTC system. Using case-mix weighted certified staffing ratios as an indicator of care quality, our results show that a 10% increase in care prices raises certified staffing ratios by 3–4%. While this result may seem intuitive, it comes with an unintended side effect: Since many Swiss cantons limit their reimbursement for LTC, our finding implies that these cantons also limit the quality of care. Most importantly, we find a strong positive association between certified staffing ratios and lodging prices, although it is illegal for Swiss nursing homes to cross-subsidize nursing care with lodging prices. Nursing homes likely use higher lodging prices to signal higher quality of care. Furthermore, competitive pressure might lead more nursing homes to subsidize staffing ratios. In line with the literature (e.g., Comondore et al. (2009)), we also find lower certified staffing ratios in for-profit nursing homes than in non-profit nursing homes.

TABLE 5 Robustness checks: Regression results for the number of registered nurses per 1000 care days

	(1)	(2)	(3)	(4)
	Similarity of surrounding nursing homes			Cantons with maximum costs excluded
	+/-8 beds	+/-12 beds	No conditioning on ownership	
Log daily price for				
Nursing care	0.335*** (0.081)	0.347*** (0.077)	0.338*** (0.084)	0.403*** (0.079)
Lodging	1.030*** (0.396)	0.899*** (0.341)	0.991** (0.429)	1.016** (0.486)
Subsidies	0.048*** (0.014)	0.044*** (0.012)	0.047*** (0.014)	0.050*** (0.016)
Private	-0.127*** (0.031)	-0.120*** (0.028)	-0.125*** (0.031)	-0.127*** (0.032)
Number of beds	-0.094*** (0.018)	-0.094*** (0.017)	-0.094*** (0.017)	-0.108*** (0.019)
Population 65+	-0.025 (0.032)	-0.025 (0.031)	-0.025 (0.032)	-0.029 (0.034)
Unemployment rate	0.145*** (0.044)	0.137*** (0.040)	0.143*** (0.043)	0.152*** (0.046)
GDP per capita	-0.004 (0.003)	-0.003 (0.003)	-0.004 (0.003)	-0.004 (0.003)
Observations	4,390	4,390	4,390	3,712
F-statistic of excluded instruments	13.01	18.38	14.60	11.24

Note: Canton and year fixed effects are included in all specifications. Reference groups: Non-private nursing homes. In the first and second columns the lodging price is instrumented using nursing homes within the same canton that are most similar in terms of beds (+/- 8 beds and +/- 12 beds, respectively), ownership type and urbanity. In the third and fourth columns, we use the standard approach with +/- 10 beds, but (i) do not control for ownership type when constructing the instrumental variable and (ii) do exclude the cantons with maximum instead of norm costs in the fourth column. Registered nurses and care prices are weighted by case-mix.

Standard errors are clustered at the canton-year level

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

Source: FOPH (2021), own calculation.

While the Swiss reimbursement system is unique in the explicit separation of nursing care and amenities, which we exploit for the causal interpretation of our estimates, reimbursement limits are common practice in many LTC systems. In the US, Medicaid reimburses nursing homes a fixed price, which varies at state level and is intended to cover both the nursing care and amenities (Feder et al., 2000). Thus, neither system includes incentives for care providers to increase certified staffing ratios. In Germany, price limits are set below the full costs for nursing care, that is, the residents need to pay for any nursing care above the reimbursement limit as well as for accommodation and services out of pocket (Nadash et al., 2017). This leaves the nursing homes some flexibility to negotiate with the payers above-average prices when providing higher staffing ratios up to a certain state-specific limit (given by predefined staffing ratios and collective wages). Policymakers need to consider this trade-off between quality and cost-containment when setting reimbursement levels. This consideration is especially important since quality of care is valued highly by nursing home residents (Lehnert et al., 2018). Like-wise, Hackmann (2019) emphasizes that current nurse staffing ratios in the US are inefficiently low since the residents' marginal benefits would exceed the costs for an additional nurse. Compared to our results, he finds an even larger effect of prices on quality of care for the US nursing homes market: a 10% increase in Medicaid reimbursement rates raises the number of skilled nurses per resident by 8.7%. The increase would lead to a yearly welfare gain of \$31 million or 9.3% of the increase in Medicaid spending. While we would expect smaller effects for Switzerland since the average quality level is higher than in the US (e.g., the ratio of qualified nurses to the number of LTC recipients is 25% higher in Switzerland (Dyer et al., 2019)), our results show that increasing the reimbursement level for nursing care would likely increase staffing ratios and thus quality of care.

Our data does not allow us to show the extent to which increases in staffing ratios lead to improvements in clinical care. We therefore follow the literature and argue that there is a causal relationship between certified nurse staffing ratios and care

quality, for example, shown by Lin (2014) using the count of deficiencies and the fraction of residents with pressure sores or contractures. Furthermore, our instrumental variable approach does not allow us to use nursing home-specific fixed effects due to insufficient variation. However, the results of the FE and IV models point into the same direction and provide a lower (1.5%) and upper bound (10%) for a 10% increase in the lodging price.

While a positive effect of care prices on certified staffing ratios might not be surprising, the positive relationship between the lodging price and certified staffing ratios raises equity concerns. Undesired spill-over effects might exist if public financed care prices are capped out of affordability concerns, but private out-of-pocket payments for accommodation and services are unregulated. As our results show, nursing homes use private co-payments to finance higher quality of care. Furthermore, according to the Swiss constitution, the Swiss Confederation and the cantons are required to ensure that every person receives the necessary LTC (Art. 41 (The Federal Council, 2021a)). Considering the differing staffing ratios across cantons, it is questionable as to whether this requirement is met. While richer cantons may choose to provide more than the minimum quality required, sufficiently high minimum quality standards are necessary to ensure that adequate care is provided everywhere and that costs are not transferred to the nursing home residents through higher lodging prices.

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CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, or publication of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available at <https://www.bag.admin.ch/bag/de/home/zahlen-und-statistiken/zahlen-fakten-zu-pflegeheimen/kennzahlen.html>.

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ENDNOTE

¹ Information on prices and staffing ratios is provided online by a non-profit organization (www.welches-pflegeheim.ch) based on a 5-star rating for the categories distance (certified) staffing ratios, prices. In addition, answers from a residents' survey are provided, yet these measures are based on small samples and do not exclusively focus on nursing care.

² No ethical approval needed for this study.

³ In addition, there is an ongoing debate over whether private equity ownership, which applies to a small but growing share of US nursing homes, affects nursing home quality (Braun et al., 2020; Gupta et al., 2021).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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