The effect of care home closures on the quality of care homes nearby*

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Abstract

This paper is the first to present evidence for the English care homes market on the causal effect of care home closures on other care homes in the market. The effect is a priori ambiguous. To identify the effect of closures I use an IV strategy on public administrative data that exploits the fact that care homes closures may be the result of a consolidation strategy from their care provider group to preserve its financial situation and carry on with its long term care activities. The main results show that incumbent care homes downgrade their quality after the closure of a care home nearby. The effect is moderate and decreases over time. I explore several explanations for this finding investigating mechanisms based on the frequency of quality inspections carried out by the regulator and alternative destinations where residents may go in the event of closure. I find an increase in the number of inspections of remaining care homes whereas do not find evidence of an increase in the proportion of people providing informal care in the local authority or in emergency admissions of the nearest healthcare centre to the closed care home.

Keywords: Care homes, quality, long-term care, England, closures , market

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1 Introduction

During the first half of 2018, almost a third of the English local authorities experienced a closure affecting about 3,300 people in total (see Association of Directors of Adult Social Services (2018)). Ensuring an adequate provision of care-home places is essential for preserving the access to long term care for older and more dependent population. It is also a key determinant of delayed discharges from acute care wards in hospitals[1]. Given their importance, the implications of care home closures are an increasing public concern. Whilst most of the little literature addressing the consequences of care home closures has been focused on the distress produced on care-home residents (see for example Netten, Darton, and Williams (2003)), less is known about the consequences in other care homes[2]. This paper aims to fill this gap by investigating the effect of closures on the quality of care homes nearby within the same local market.

Several reasons make quality an important aspect for care homes. Firstly, care homes are inspected and regulated according to the quality of their services. In some cases, if care homes do not provide enough quality after several inspections, they may be enforced to abandon the market. Secondly, and more important for the purposes of this paper, care homes use quality alongside prices to attract to residents. In such a framework, with competition in quality and prices, the theoretical literature shows that competition and market structure have an ambiguous effect on the quality for the health sector. More intense competition may lead to two counteracting effects that consist of an incentive to provide more quality to increase the demand for given prices or a disincentive to invest in quality due to the reduction in the price-cost margin (Gaynor & Town, 2011). Ma and Burgess (1993), for instance, show that both effects compensate

[1] Gaughan, Gravelle, and Siciliani (2015) and Gaughan, Gravelle, Santos, and Siciliani (2017) conclude that the provision of care homes affects the bed blocking in near hospitals.

[2] Glasby, Allen, and Robinson (2018) highlight the lack of formal evidence about what happens when care homes close

each other resulting in a null effect from competition. Conversely, Breeke, Siciliani, and Straume (2010) show a positive effect of competition on quality when consumers have a decreasing marginal utility of income. Furthermore, Brekke, Siciliani, and Straume (2018) show that competition may lead to negative utility if providers have an altruistic motivation and have a decreasing marginal utility in their profits.

The market for long term care in England is fairly competitive so that closures are likely to be driven by those care homes that are not efficient nor competitive enough to maintain quality standards (Allan & Forder, 2015). In this situation, the remaining care homes would be competitive, compete on quality to attract clients and increase both their market share and profit. These elements, more financially sound providers and an overall increase in the level of quality in the industry, may lead to a positive effect on the quality of the services provided by the remaining care homes (Netten, Williams, & Darton, 2005). Castle, Engberg, and Liu (2007) find evidence supporting this argument showing that more concentration in the market is associated with an increase of quality of the care homes.

Closures may also have negative consequences for the quality of incumbent care homes. Particularly, if closures are sudden, there is a lack of coordination between the parts involved in the process and incumbent care homes operate at their maximum capacity. For instance, an increase of clients from a forced relocation may imply a reduction of the time dedicated for caring by the staff of incumbent care homes. This would be translated into reductions in the quality of the service[3]. Also, in case there are agglomerations in the care homes industry, incumbent care homes would not be benefited from potential complementarities from the proximal closing care home. Empirically, determining the effects of a closure on the quality of a neighbouring care home is a difficult task. The

[3]There is a wide consensus on the positive relationship between nursing staffing levels and quality (Harrington, Schnelle, McGregor, & Simmons, 2016). Lin (2014) for example, uses an instrumental variables approach on american nursing homes data and finds that an increase of 0.3 hours a day of registered nurses increases the quality of care more than 16%.

decision of closure may be determined by factors in the local market that also affect the quality of the remaining homes thereby masking the effect of closures. For instance, long term care providers may decide to close in those areas where they expect to obtain lower returns. A simple comparison of the quality between care homes that have a closure nearby and care homes that do not would provide a spurious effect without causal interpretation.

I tackle this problem and identify the impact of closures by exploiting the fact that care homes closures may be the result of a business strategy from their care group. Concretely, there may be long term care providers with several care homes across the country that may decide to consolidate and reduce their capacity, expressed by the number of care homes in the care group, to preserve their financial situation and carry on with their activities. I therefore define a "consolidation" variable that operates as instrument for care home closures and which is independent to the quality of the care homes nearby. To use only plausibly exogenous variation, I focus on relevant consolidations of active providers that involve the closure of care homes located in different local authorities that are in different regions of the country. The validity of this identification relies on two main assumptions. First, that there is no selection of care homes with different local characteristics in areas where there is a consolidation. Second, that care homes consolidations affect the quality of incumbent care homes only through the closure of care homes.

Using this identification on a sample composed primarily of administrative data from the Care Quality Commission (CQC), the regulator of long term care services, I am able to disentangle the effect of closures from other confounding factors. I find that closures negatively affect the quality of care homes nearby. In particular, relative to those care homes that do not have a closure, closures result in quality deteriorations expressed as decreases in their quality rating. This effect, however, is moderate (about half of a

standard deviation), decreases over time and vanishes when increasing the radius of the catchment area. The results suggest that regulators and local authorities could be aware of the negative implications resulting from closures and anticipate potential adverse effects by carrying out actions parallel to the closing process. I explore this argument by analysing the effect of closures on the number of total inspections conducted on a care home. I find that closures operate as an "alarm system" that lead to more inspections of the nearest incumbent care homes. Likewise, I investigate the effect of care home closures on other potential destinations of displaced patients in addition to a care home. In particular, I analyse the effects of closures on providers of informal care in the local authority and on the admissions of old patients (aged 70 or more) to emergency wards of hospitals near the closing care home. Results from these analyses show no evidence of an effect resulting from closures.

This study is primarily related to the body of literature that analyses the effect of the market structure on the quality of long term care services. It contributes to the literature by being the the first study to analyse the English care homes market. To this extent, this paper complements other studies that have been focused on the American market (see for example Ching, Hayashi, and Wang (2015), Lin (2015) or Bowblis and Vassallo (2014)). Indeed, the closest reference to this paper is Bowblis and Vassallo (2014) who analyse the effect of closings on the quality of rural nursing homes in America. This paper diverges from this analysis in a number of ways. Firstly, it extends the analysis by focusing on the whole set of registered care homes in England, regardless of whether they are located in rural or urban areas. Secondly, instead of the difference-in-differences approach that compares the quality of care homes that are in the same and different geographic markets as the closing care homes, this paper identifies the effect of closures by means of the instrumental variables strategy outlined above. Thirdly, Bowblis and Vassallo (2014), as most studies in the literature, examine the quality of care homes on the basis of

different measures. This paper uses a quality rating that reflects the multidimensional characteristics of long term care services. The use of this type measure, which is collected systematically, may allow for more conclusive results and avoid problems of mixed evidence dependent on the choice of the quality measure Grabowski (2001). This paper also adds to the literature by analysing the market structure through closures instead of measures of concentration[4]. Hence, most of the literature using the former has focused on the causes that lead to failure (see Allan and Forder (2015) or S. J. Machin and Wilson (2004) studying the case of England). Yet, there is a lack of evidence on the implications derived from these procedures for the remaining care homes in the market. This paper addresses this point.

Moreover, this paper is also linked to the empirical literature that has examined the interactions between competition and quality in the care-homes market (Forder & Allan, 2014; Netten et al., 2003). Forder and Allan (2014), suggest that more competition does not lead to more quality in scenarios where prices can only pay for the provision of minimum quality and buyers are not interested in quality but only in cost. Unlike this research, the findings of this paper reveal that less competition leads to decreases in quality.

2 Long term care in England

2.1 Institutional background

The analysis uses data on care homes. Care homes are with home care the main alternatives for receiving formal, paid, long term care in England. The market is composed mainly by for profit providers (about a 90%). The remaining 10% is composed by public and voluntary providers. Furthermore, the set of private providers is divided by those

[4]As noted by Forder and Allan (2014) or Forder and Allan (2011), most of the studies analysing the links between market competition and quality, predominantly measure market concentration by a county level Herfindhal index

providers that have an important capacity[5] in terms of beds and those that have a small capacity and are composed essentially by family business. Lievesley, Crosby, Bowman, and Midwinter (2011) argue that this type of care homes are normally the ones that exit the market. In addition of being small, these facilities have low occupancy levels and often are the only care home in the care group.

The demand for care homes distinguishes two types of residents. On the one hand, residents that self-fund their care. These have a solid financial position that enables them to afford their care needs. The other part of the demand are residents who cannot afford their care and therefore receive some degree of public support. The eligibility for public support consists of a means test that determines the financial capacity. If patients do not meet a certain threshold, they receive some sort of support. For these clients the market operates as a quasi-market where the local authority commissions (e.g. purchases) their care on their behalf.

Care homes normally host both sorts of residents. Yet, considering the same type of service, the prices paid by self-funded residents normally exceed the prices paid by publicly supported residents[6]. Allan, Gousia, and Forder (2017) assess empirically the determinants for this difference in the fees paid by self-funded and publicly-supported residents concluding that the main driver for the gap, which is estimated in about £40 a week, is based on the local authorities' market power applied in the negotiation of the contracts for publicly-supported residents. This result had been previously developed theoretically by Hancock and Hviid (2010) for the English care home market. Allan et al. (2017) also explore other aspects such the vertical quality differentiation by which self-funded residents would have a greater preference and a more willingness to pay for quality. Although they find a positive effect derived from this mechanism, the magnitude

[5]The top 25 biggest providers account for 31% of all beds. Within that group, half of the beds correspond to the *"Big Four"* (Jarret, 2018).

[6]This difference in prices is also prevalent in other markets such as the US. Private self-funded residents pay a 30% more than Medicaid providers (Grabowski, 2004; Mukamel & Spector, 2002)

is small.

There are 152 local authorities responsible for the management of long term care. In addition to funding care in some cases, they also provide care and manage patients in the events of care-homes closures. Hence, if a care home closes, the corresponding local authority where it is located needs to preserve the provision of care and ensure that displaced patients receive care in a suitable place. Yet, local authorities are not required to fund the long term care services for displaced residents unless they are subject to some sort of public support.

2.2 Quality of long term care services

Since October 2014, care homes are inspected according to a new inspection system monitored by the CQC. The main difference compared to previous systems, is that the new system implemented more systematic inspections driven by five so called *key lines of enquiry (KLOEs)* that structure the inspections in sets of 5 key questions. These questions are associated with issues to determine to what extent services are safe, effective, caring, responsive to people's needs and well-led. In addition to the assessment of each of these dimensions, the CQC also releases an overall rating. Both the overall rating and each of the other 5 questions are rated according to four possible categories: outstanding, good, requires improvement and inadequate.

An important component of the system is that the inspections are carried out without prior announcement. Also, the frequency of inspections is determined by the rating obtained. Thus, worse ratings lead to more frequent inspections. Obtaining an "inadequate" rating implies the adoption of special measures, close monitoring and a re-inspection in 6 months (Care Quality Commission, 2015). The information used to derive the ratings is obtained from different sources that include quantitative measures, the direct observation

from the inspectors and the feedback from both patients, relatives and staff working in the care homes (Barron & West, 2017).

3 Data

As outlined in previous section, this analysis observes care homes over a period that spans from October 2014, the date when the new quality system was implemented, to March 2018. The data consist of 30,061 administrative records referring to daily inspections of 17,104 care homes. The main source of information consists of the registry of registered and deactivated care providers released by the CQC. The next subsections provide further details on the main variables of the analysis.

3.1 Quality inspections and downgrades

The main dependent variables are the number of inspections and the deterioration on quality ratings. Both are obtained from the directory of registered care providers. This is a publicly available dataset that reports monthly comprehensive information on active care providers. I select information only referred to care homes[7].

The main characteristics of the care home besides its identification code and name include details of the location, date of registration in CQC, main service provided, number of beds, local authorities where the care home is located (local authority responsible for social services) as well as a set of characteristics related to the provider. Likewise, and key for the analysis, it contains information on the overall rating corresponding to the last quality inspection in the care home. This overall rating summarises the performance of several issues of the care home and addresses the multidimensional nature of quality in the

[7]In addition to care homes, this register contains information on acute hospitals, acute services that are not hospitals, ambulance services, community services, dentists, GP practices, hospice services, independent consulting doctors, mental health, out of hours, remote clinical advice, substance misuse services and urgent care services

care home (Bowblis & Vassallo, 2014). Also, by collecting monthly records, it is possible to track and measure the number of inspections carried out in a care home during the period of analysis. Each inspection is associated with a rating namely: "Outstanding", "Good", "Requires improvement" or "Inadequate". To obtain a measure of quality deterioration I create a dummy variable defined as 1 if the care home moves from "Outstanding" or "Good" to "Requires Improvement" or "Inadequate" and 0 otherwise. Gonzalo-Almorox, Braakmann, and Wildman (2018) use similar measures to assess the effect of changes in local public budgets on the quality of care homes.

I supplement the former information regarding the characteristics of the care home with the postcode directory from the Office of National Statistics as to November of 2017. This dataset gives information about the geographical coordinates (e.g longitude and latitude) of the care home and it is used to construct the main explanatory variable, *care home closures*, and the instrument, *care home consolidation*.

3.2 Care home closures and care home consolidations

To obtain the care home closures and care home consolidations I use information from the directory of deactivated care providers also released by the CQC on a monthly basis. This dataset presents similar characteristics to the directory of registered care providers in terms of the information released. The main additional information that this dataset includes is the date of care home deactivation since 2010. In the analysis, I assume this date as the closure date of a care home. For calculating *closures* I remove those records that represent a deactivation but are originated by administrative changes in the care home such as modifications in the ownership or in the number of beds. Although registered as deactivated, these records do not represent real closures but a recoding of the care home identification.

To determine the degree of closeness I firstly group active and closed care homes that share the same local authority with responsibilities in long term care services. I use this definition of local authority instead of districts[8] since these deal with care home contracts and are also responsible for the reallocation of patients in case of care home closure. Secondly, I determine the catchment areas by calculating the geodesic distance[9] which is the shortest curve between the geographical coordinates of a closing care home and the active care homes within a geographic radius of 5, 10, 15 and 20 kilometres in the local authority.

Figure 1 shows two snapshots of the spatial variability of care home closures across English local authorities for a catchment area of 20 kilometres. Considering all local authorities, closing care homes are on average about 9 km away from active care homes. Not surprisingly, care homes located in London have nearer closures than care homes in other parts of the country. This pattern of closing care homes nearby is also found in several local authorities of the North and to a less extent some areas of the South. Looking at the number of care homes closed, there is more heterogeneity. Local authorities placed in East and Northwest regions, show fewer care homes closing (between 1 and 5). Conversely, areas in the North, West and South East present the greater levels of care home closures (between 14 and 53 care homes).

As outlined before, the directory for unregistered care homes also gives information on the care home providers. Therefore, it is possible to know the number of care homes that a provider deactivates in a period of time as well as when and where these deactivations take place. This is valid information to determine whether the provider is carrying out a consolidation of the group by reducing the number of active care homes. Section 4

[8]Districts represent the local authorities at the lower level responsible for managing local policies such as housing. England has 325 local authorities operating at this level. Hence, some districts may share the local authority that is in charge of long term care services and which operates at upper (e.g. county) level.

[9]These distances are calculated in R using the *distGeo* function from the geosphere package (Hijmans, Williams, & Vennes, 2012).

discusses in further detail the rationale of the instrument.

The analysis also incorporates several variables used as controls for the composition of local demand and supply of long term care. These variables, which are collected from the Department of Work and Pensions at the local authority district level due to data availability, include the share of elderly population (e.g. aged 85 or more) and share of people with care allowance over the total adult population. These are proxies for the demand and the level of need for long term care services that have been used in the literature previously (see Fernandez and Forder (2015) for example). Since long term care is a labour intense activity where labour force is around minimum wage (see S. Machin, Manning, and Rahman (2003) or S. J. Machin and Wilson (2004) for analyses of the UK care home market), the share of claimants for job allowance is normally used to characterise the supply of long term care services. Finally, since bad ratings are associated with more frequent inspections and care home closures (Allan & Forder, 2015), I use as control the total number of inspections rated as "Inadequate" or "Requires improvement" in the LSOA[10] where the care home is located.

Given the different number of inspections carried out in each care home, our sample of analysis corresponds to an unbalanced panel. Table 1 presents descriptive statistics of the variables used for the analysis. On average care homes are inspected twice as to March 2018. Nonetheless, there are some cases where a care home has been inspected 8 times. About one fifth of the observations in the sample, report quality deterioration. This figure is similar to the figures released by the CQC in their state of health and social care for 2017[11]. There are large differences across local authorities with regards to characteristics of the supply. Specifically, in terms of the number of informal carers in each local authority.

[10]This is smallest geographical area in England that groups about 1500 people.

[11]See page 29 in https://www.cqc.org.uk/sites/default/files/20171123_stateofcare1617_report.pdf for further details

4 Empirical strategy

The link between the effect of care home closures on neighbouring care homes' quality can be conceptualised with a reduced form equation as follows

$$Y_{clt} = \alpha_l + \theta_t + \beta_{clos} Closure_{jclt} + \lambda X_{lt} + \epsilon_{clt} \tag{1}$$

where Y is the outcome of interest, e.g, number of inspections and quality deterioration for care home c at time t in local authority l. The specification includes two sets of fixed effects: Local authority fixed effects α to capture factors happening in the local authority and which are time invariant and year fixed effects θ to incorporate common shocks for all local authorities that occur during a year such as political changes at national level. $Closure$ is a dummy variable equal to 1 if there is a care home j in the same local authority l that closes near care home c in a period of time t and 0 otherwise. In addition to catchment areas described before, the analysis also considers various time windows of one, three, six and twelve months respectively.

The parameter of interest which may be interpreted as the causal effect ofmclosures on the quality inspection and deterioration of neighbouring care homes is β_{clos} . The reduced form in 1 is estimated by OLS. The estimates can be interpreted as causal if they are orthogonal to the standard error ϵ. Yet, as outlined in the introduction, there may be aspects that may raise endogeneity concerns and that may invalidate such interpretation of the reduced form model. For instance, there may be local shocks that may affect the composition of the potential local clientele. These may influence both the quality of the services in local care homes as well as their profitability. Under that situation, some providers may decide to close care homes in certain areas whereas at the same time other providers may modify their business model and therefore alter the quality of the services

they deliver.

To control for these local aspects, Equation 1 also incorporates a time varying vector X with the local variables discussed in section 3. Thus, X includes the share of elderly population, the share of people with care allowance, the share of claimants for job seekers allowance and the number of bad inspections (e.g. inspections rated as "Inadequate" or "Requires improvement") in the LSOA.

Despite controlling for these variables, there may be still unobservable factors that may cause omitted variable bias. To generate plausibly exogenous variation in the incidence of care home closures, I exploit the fact that closures may be part of a consolidation strategy in their corporate group. In this business strategy, care home providers decide to close several care homes to reduce their capacity and preserve their financial sustainability. In this case, the decision of closure may be motivated by external factors (business strategy) rather than local elements of the market. Considering this rationale, Equation 1 is complemented with a first stage regression.

$$Closure_{cilt} = \lambda_l + \kappa_t + \beta_{cons} Consolidation_{lt} + \delta X_{lt} + u_{cilt} \tag{2}$$

where consolidation is a dummy variable that indicates whether a care home closure is pat of a consolidation ($Consolidation = 1$) and 0 otherwise and the parameter β_{cons} measures the effect of consolidation on care home closures, relative to care homes that close but not as a consequence of a consolidation. In the context of this identification strategy, a reasonable hypothesis is to think that some local factors may remain as drivers for the consolidations. Providers may decide to close those care homes that have the worst performance within the group and this performance may be influenced by local factors.

To address this potential problem and use only plausibly exogenous consolidations,

I focus on consolidations that meet three specific criteria. First, the provider that carries out the consolidation must be active by the end of the period of analysis (i.e. March 2018). Second, the provider has to undertake closures in 4 or more different local authorities with responsibility on long term care services within the same year. To avoid that consolidations are carried out in neighbouring local authorities, the third condition establishes that the local authorities where consolidations are undertaken must correspond to at least 2 different regions. Table 2 shows descriptive statistics for the two types of providers that close care homes using data from the directory of registered care homes and considering local authorities at their lower level (e.g. district level). Providers that carry out consolidations are large institutions with an average of 62 care homes operating in almost 10% of the districts and with a widespread presence over the country (in average 5 regions out of 9). On the other hand, most providers that close have only 1 care home and operate in a district. The former suggests that the majority of care homes that close are likely to be family businesses as suggested by Lievesley et al. (2011).

The validity of this empirical strategy relies on two main identifying assumptions. The first assumption is that consolidation is not correlated with ϵ. The plausibility of this assumption entails that the instrument is as good as randomly assigned. In the framework of this paper, this assumption entails that districts with and without consolidated care homes do not present a priori significant differences in their background characteristics. Otherwise, providers that consolidate could motivate their decision based on particular characteristics of certain local authorities and that would invalidate the validity of the instrument. Considering again the definition of the local authority at the lowest level, I test this assumption by comparing a number of variables associated with care homes from districts that have a consolidation and districts that do not. Table 3 reports the results of these comparisons. In general, we do not observe significant differences between the two types of districts. The only exception remains the share of old people with a difference of

0.2 percent points.

The second assumption entails that the consolidation in the group of the closing care home affects the quality deterioration of the care homes nearby only through the closure of the care home. This assumption implies that a consolidation only affects the quality of neighbouring care homes by the change produced in the market structure. This assumption could be violated if the consolidation in the closing care home group affected massively several markets due to a lack of confidence by the patients that resulted in sudden emptied care homes belonging. In the care homes sector this situation is unlikely. Similar situations represented by collapses of big providers, in 2011 and 2013, have have led to the acquisition of the failed care homes by other providers but not relocated patients[12]. Furthermore, since 2014 the CQC has implemented a regulation aimed at preventing such failures[13].

Considering the former, Equation 1 is transformed into the following second stage equation

$$Y_{clt} = \alpha_l + \theta_t + \beta_{clos}\widehat{Closure}_{jclt} + \lambda X_{lt} + \epsilon_{clt} \tag{3}$$

Equation 3 regresses quality deterioration against the predicted number of closures ($\widehat{Closure}$) estimated in Equation 1. The parameter β_{clos} yields the effect of care home closures on the probability of quality deterioration in the care homes.

[12] A report about the stability of the care homes market, providers did not find evidence about a risk of contagion in case of failure. It concludes that failures normally respond to market corrections (Institute of Public Care, 2014)

[13] Further details about the Market Oversight regime by the CQC can be found in https://www.cqc.org.uk/guidance-providers/market-oversight-corporate-providers/market-oversight-adult-social-care

5 Results

5.1 Effect of closures on the quality deterioration

Table 4 shows results on the effect of closures on the quality deterioration of care homes within a catchment area of 5 km. The upper panel shows OLS estimates of Equation 1. It seems plausible that incumbent care homes react differently depending on when the care closes. Hence, the first column shows results for a time window of 3 months between the closure and the inspection and columns 2 and 3 show estimates for periods of 6 and 12 months respectively. All estimations include local controls, fixed effects at the year and district level and errors are clustered at the level of the LSOA of the care home. The results show that a care home closure is associated with a significant deterioration of quality in the care homes nearby. This association increases when increasing the time window between the closure and the inspection.

As explained above, the OLS results are likely to be biased because of the influence of confounding local factors that hinder the identification of the closure's effect. Panels (B) and (C) of Table 4 show two stage and first stage estimates of care homes closures on the quality deterioration of nearby care homes (Equations 2 and 3). The values of the *Kleibergen-Paap* F statistics associated with each specification exceed the critical value of 16.38 proposed by Stock and Yogo (2005) for one endogenous variable and one instrument. Therefore, the null hypothesis that the instrument is weak can be rejected. Also the results show a significant positive association between the consolidations and the closures that increases with the time between the closure and the inspection.

Looking at the Panel (B) of Table 4 we observe a positive effect of closures on the quality deterioration of care homes nearby. When the closure occurs within the three months before the inspection, the quality deteriorates by 0.196 points. This effect shrinks progressively over time being 0.0609 when the inspection occurs within a year since the

closure. In terms of standard deviations, results range from about 50% (0.39) to a 15% of a standard deviation in twelve months. Regardless of the time period between the closure and the inspection, results are significant at a 10% significance. Results are similar when including local authority fixed effects at a wider level and with different error specifications (see Tables 9 and 10 in Appendix B).

Comparing the results from the OLS and IV estimates, we can see that IV coefficients are generally larger (in particular for shorter periods of time between the closure and the inspection). This can be explained by the fact that the OLS estimation includes local factors that may improve the quality and partially offset the negative effect from closures found when applying the instrument. For example, the literature has identified several local factors such as a better inclusion of the care home in the community (Wiener, 2003) and a better coordination among the different stakeholders (e.g. NHS services and primary care GPs) involved in the process of care (Baylis & Perks-Baker, 2017) as key elements to enhance the quality of care homes.

These results indicate that treated care homes, care homes with a closing care home nearby, are negatively affected in the short-run. A potential explanation could be that incumbent care homes do not have a suitable set of resources to offset an unexpected increase in the demand and address a potential forced relocation of the patients from the closing care home. For example, issues such as the number and conditions of staff are important determinants for the level of quality. Bearing in mind that long term care is a labour internse activity, if care workers from incumbent care homes feel more pressure, the quality of the service they provide is likely to decrease. Other studies, such as Allan and Vadean (2017) have addressed this issue and analysed how working conditions affect the level of quality. They conclude that poor conditions such as low payments or high turnover rates, affect negatively the quality of care homes.

A potential concern of this analysis is that results might differ when varying the

size of the catchment area. I define wider care home catchment areas within the local authority responsible for long term care services and check the robustness of results in Table 5. Results in Table 5 are for catchment areas of 10, 15 and 20 km and are consistent regardless of the area of the market considered. Yet, when considering catchment areas of 15 and 20 km, the effect of closures dissapears.

In general, the weak statistical significance suggests that the effect of closures does not vary significantly between care homes that have a closing care home nearby and a those do not have a closing care home. One explanation to this result would be related to the procedures of closing care homes. As outlined before, in the event of closure, local authorities are responsible for the allocation of displaced patients. It seems plausible that in such an event, local authorities allocate displaced patients to those care homes that have enough capacity to provide care under the minimum quality standards imposed by the CQC.

5.2 Effects of closures on number of inspections

Another explanation for the low significance of results in Table 4 may be that closures operate as an *"alarm system"* for the CQC. Given the positive association between quality downgrades and closures shown by Allan and Forder (2015), the CQC would give more attention to those local markets where there is a closure. The rationale would be to anticipate potential negative consequences on incumbent care homes' quality derived from closures of care homes nearby. Consequently, the CQC would inspect more frequently care homes nearby and ensure that minimum quality standards are met.

I test this conjecture by investigating the effect of closures on the total number of inspections carried out in the nearest registered care home. Results are reported in Table 6 and estimates are obtained by re-estimating Equations 1, 2 and 3 using now the number

of total inspections carried out in a care home as the outcome variable. Furthermore, the analysis is based on catchment areas of 10 and 20 km respectively. These distances better approximate the area of action for CQC inspectors in local long term care markets. The structure of Table 6 is similar to previous tables and displays results in terms of 3, 6 and 12 months since the care home closure.

From Panel B, considering a catchment area of 10 km, we observe that closures increase the number of inspections by 0.639 points (a 63% of a standard deviation) in the first 3 months. This effect shrinks as time goes by and results in increases of 0.181 points (a 18% of a standard deviation) in the 12 months after the closure. Results are similar for a catchment area 20 km. These findings, which are significant at the 5% level, confirm the idea that the CQC increases its control over the incumbent local care homes when there is a closure of a care home nearby.

5.3 Effects on informal care

Another argument to explain the main results in Table 4 consists of looking at alternatives for displaced patients. The natural option for displaced patients from a closed home would be another care home. This conjecture could be tested by using information on care home attendances. Yet, there is not publicly available information on the number of patients referred to each care home. In case there are not available places in a care home, displaced patients may be cared informally care. As in other countries such as Spain or US, this is the most common form of long term care giving in England (Sole-Auro & Crimmins, 2014)[14].

In this subsection I explore the effects of closures on the proportion of people of the adult population that provide informal care in the district. Results are shown in Table 7

[14]The Office of National Statistics estimate that informal carers were providing care worth £57 billion (Office National Statistics, 2017)

considering a catchment area of 5 Km[15] for periods of 3, 6 and 12 months since the care home closure. Estimates from Panel B show a reduction in the proportion of people that provide informal care as a consequence of the closures. In terms of the patterns of the results, we observe the same trend of previous tables by which the effect of the closure decreases over time. Regardless of the catchment area, this effect is small and it is never statistically significant.

These results are in line with what has been found in previous work. Using a case study approach, Williams, Netten, and Ware (2003) study the perspective of informal carers in care home closure events. They conclude that most residents moved to other care homes but with different owners (84% of their sample).

5.4 Effects on the A&E departments

Results from section 5.3 do not support the hypothesis that displaced patients return to their home and receive informal care. In this section I explore whether displaced patients may be referred to other facilities such as A& E wards. England has registered an increase of emergency admissions of 42% over the last twelve years (Steventon, Deeny, Friebel, Gardner, & Thorlby, 2018). An important part of those have been admissions which could be avoided by an effective community care and case management (National Audit Office, 2018). Concerning patients coming from care homes, Smith, Sherlaw-Johnson, Ariti, and Bardsley (2015) conclude that such patients experienced between 40% and 50% more admissions to A&E departments than other patients.

I investigate the effect of closures on attendances of the A&E wards of the nearest hospital. For this analysis I use information from the NHS Digital for years 2014 to 2017 concerning 170 health centres[16]. In particular, I use aggregate information on attendances

[15] Results are similar for catchement areas of 10 and 20 Km.
[16] Appendix C provides further details and summary statistics of this sample

of patients who are aged 70 or more. Patients over this age range are more likely to be affected by a care home closure. For this analysis I estimate a similar Equation to 1

$$Y_{ilt} = \alpha_l + \theta_t + \beta_{clos} Closure_{jclt} + \lambda X_{lt} + \delta h_{lt} + \epsilon_{clt} \tag{4}$$

where Y represents the A&E attendances of patients of different age groups in hospital i in local authority l during year t. $Closure$ represents a dummy variable that indicates whether a care home closed near that hospital ($Closure = 1$) . Yet, unlike Equation 1, Equation 4 incorporates h_{lt} which is a control that indicates whether the second closest hospital to the closing care home is within a catchment area of 5 Km.

Results are displayed in Table 8. Columns 1,2,3 and 4 present information for the whole sample of patients and subsequently patients aged 70 to 80, 80 to 89 and 90 or more. Results reveal a positive, although statistically insignificant, effect derived from care home closures that is greater for the oldest patients (90+). These findings suggest that in case of closures, the oldest people are likely to be referred to a hospital rather than re-allocated to a new care home. It seems plausible that this group of patients are more frail and dependent and therefore require a more specialised care that is more difficult to be provided in the remaining care homes.

6 Discussion and conclusion

The closure of a care home may have important implications for long term care services. Yet there is little evidence assessing the consequences of closures. Whereas most evidence has been focused on the consequences for displaced residents, the effects on other care homes in the market have been less researched. This paper is the first attempt to address

this question for the case of the English care-home market by looking at the effects on the quality of the remaining care homes.

This paper finds some evidence associated with a negative effect on the quality of the care homes in a market as a consequence of a closure in a care home nearby. This effect is, however, small and decreases over time. I examine several hypotheses that help to explain the results in more detail. First, I evaluate how closures affect the control by CQC by looking at the inspections carried out by the regulator in the incumbent care homes. I argue that closures may be a signal that the regulator uses to control in more detail the performance of the market and tackle potential quality deteriorations. I find some evidence that suggests the former mechanism would be operating. In addition, I check the implications on other destinations where patients in closing care homes could potentially be referred to. Considering the levels of informal care and emergency services in hospitals, I do not observe significant evidence of an increase in the proportion of people providing informal care in the district nor in the number of A&E admissions in the hospitals near a closing care home. These results suggest that in case of care home closure, displaced residents are likely to move to another care home and receive similar formal care.

Considering the former points, the main findings suggest that the quality of incumbent care homes is hardly affected by closures. Since local authorities are in charge of managing the process of closure, a plausible explanation is that patients may be allocated to facilities that can cope with the new demand without sacrificing their quality. In these cases, incumbent care homes are likely to redefine its capacity to accommodate the new demand and preserve the levels of quality. Indeed, for most providers quality is the main motivation of their business – beyond profit (Knapp, Hardy, & Forder, 2001; Matosevic, Knapp, & Le Grand, 2008).

A limitation of this study is the lack of information regarding the type of residents in closing and remaining care homes. This implies that it is not possible to know how

the proportion of self-funded and publicly-supported residents affects quality. This is an important point given the likely different valuation and willingness to pay for quality of both kinds of residents. For example, self-funded clients may value quality and be willing to pay for higher levels of quality. In cases when the core clientele of the remaining care homes is composed mainly by self-funded residents, providers may differentiate vertically and discriminate in prices according to different levels of quality. Having this possibility would temper the negative effect on quality derived from a closure nearby.

Linked to that, it may be possible that care homes simply rely more on the self-funded segment of the market to cross-subsidise the lower prices paid by public residents. In such cases, an event of closure with a fair proportion of publicly supported clients may exacerbate the knock-on effect discussed by Allan et al. (2017) by which care homes exploit their market power over self-funded residents to extract their rents.

The findings in this paper may contribute to inform the design of policies to enhance the competition in the long term care market. They may also help to understand better the effects of the market structure on quality and the mechanisms by which care homes provide quality in their services.

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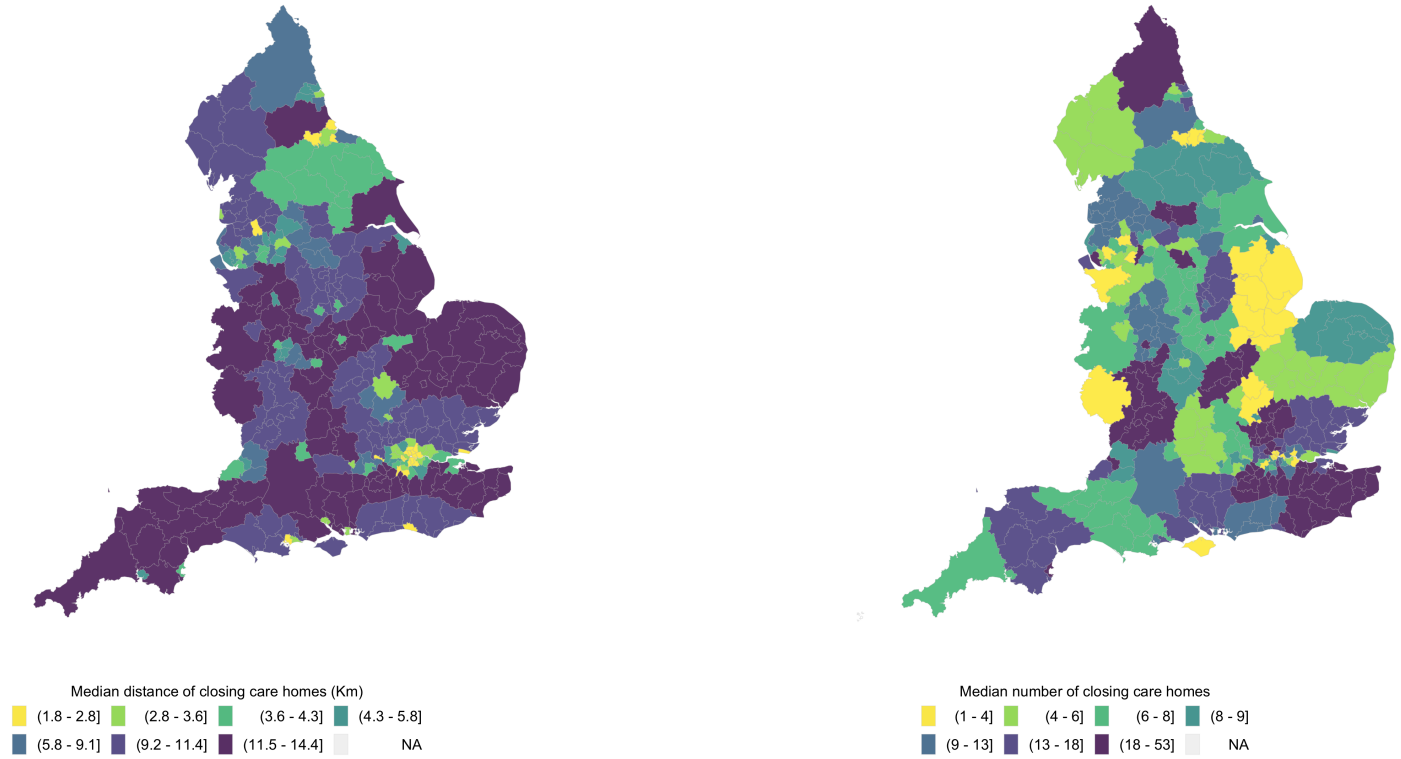
7 Figures

Figure 1: Descriptive statistics of care home closures



Note: CQC and ONS, author's own calculations. Figures represent median distance between active care homes and nearest closing care home and median number of closing care homes in the local authority. Figures are expressed in terms of local authorities at district level.

8 Tables

Table 1: Summary statistics

	Mean	S.d	Min	Max
Quality downgrade (1 = yes)	0.19	0.39	0	1
Total number inspections in care home	2.16	1.01	1	8
Closure within 3 months (1 = yes)	0.03	0.16	0	1
Closure within 6 months (1 = yes)	0.05	0.22	0	1
Closure within 12 months (1 = yes)	0.1	0.31	0	1
Consolidated (1 = yes)	0.01	0.12	0	1
Number of bad inspections LSOA	0.43	0.84	0	8
Proportion of carers allowance (district)	0.01	0	0	0.03
Proportion of job seekers (district)	0.01	0.01	0	0.36
Proportion people 85+ (district)	0.03	0.01	0	0.05
Observations	30061			
Care homes	17104			
Local authorities (district)	325			

Note: CQC, DWP and Census, author's own calculations.

Table 2: Summary statistics consolidated and non consolidated providers

	Consolidated providers n = 9			No consolidated providers n =7758		
	Mean	Max	Min	Mean	Max	Min
Number of beds	549	1991	6	59	10668	0
Number of care homes	62	254	1	2	167	1
Number of districts operating	32	114	1	1	113	1
Number of regions operating	5	8	1	1	8	1

Note: CQC, author's own calculations. Data as to March 2018. Consolidated providers are registered providers that close care homes in 4 or more different local authorities with responsibility on long term care activities and 2 different regions.

Table 3: Local characteristics of closing care homes

	Consolidated n = 222		No consolidated n = 2899		
	Mean	S.d	Mean	S.d	p.value
Proportion Job seekers	0.006	0.005	0.006	0.005	0.763
People providing informal care	234461	202853	230739	176808	0.791
Number bad inspections district	0.82	0.944	0.844	1.054	0.715
Proportion people 85+	0.025	0.006	0.027	0.008	0
Proportion claimants allowance	0.012	0.005	0.012	0.004	0.522
Average IMD score district	21.43	9.455	21.079	8.014	0.591

Note: DWP and Census, author's own calculations. Third column is based on a two sample t-test.

Table 4: Effects of closures on quality of nearby care homes

	Quality deterioration in care home (1 = yes) in...		
	(1)	(2)	(3)
Panel A. OLS	3 months	6 months	12 months
Closure	0.0671***	0.0720***	0.0844***
	(0.0187)	(0.0129)	(0.00965)
Observations	30,061	30,061	30,061
R-squared	0.495	0.495	0.497
Panel B. 2SLS	Quality deterioration in care home (1 = yes) in...		
	3 months	6 months	12 months
Closure	0.196*	0.129*	0.0609*
	(0.115)	(0.0752)	(0.0353)
Observations	30,061	30,061	30,061
R-squared	0.493	0.495	0.497
Panel C. First Stage	Closure care home nearest care home in 5 km		
	3 months	6 months	12 months
Consolidation	0.111***	0.196***	0.399***
	(0.0127)	(0.0164)	(0.0185)
Kleibergen-Paap Wald rk F statistic	66.12	141.99	465.05
Partial R squared	0,015	0,026	0,057

Note: CQC, DWP and Census, author's own calculations. Table shows OLS and IV results of Equations 1, 2 and 3 for quality deterioration of care homes in a catchment areas 5 km. All estimations include year and local authority (district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at LSOA level. $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.1$.

Table 5: Effects of closures on quality of nearby care homes (10, 15, 20 km)

	Quality deterioration in care home (1 = yes) in...			Quality deterioration in care home (1 = yes) in...			Quality deterioration in care home (1 = yes) in...		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. OLS	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.0671***	0.0720***	0.0844***	0.0819***	0.0854***	0.0990***	0.0793***	0.0853***	0.0988***
	(0.0187)	(0.0129)	(0.00965)	(0.0155)	(0.0111)	(0.00829)	(0.0153)	(0.0110)	(0.00824)
Observations	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.495	0.495	0.497	0.495	0.496	0.499	0.495	0.496	0.499
Panel B. 2SLS	Quality deterioration in care home (1 = yes) in...			Quality deterioration in care home (1 = yes) in...			Quality deterioration in care home (1 = yes) in...		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.196*	0.129*	0.0609*	0.115	0.0729	0.0343	0.114	0.0720	0.0339
	(0.115)	(0.0752)	(0.0353)	(0.128)	(0.0812)	(0.0374)	(0.128)	(0.0814)	(0.0375)
Observations	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.493	0.495	0.497	0.495	0.496	0.497	0.495	0.496	0.497
Panel C. First Stage	Closure nearest care home within 10 km			Closure nearest care home within 15 km			Closure nearest care home within 20 km		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Consolidation	0.124***	0.188***	0.399***	0.120***	0.190***	0.404***	0.119***	0.189***	0.401***
	(0.0200)	(0.0235)	(0.0275)	(0.0170)	(0.0213)	(0.0223)	(0.0170)	(0.0212)	(0.0222)
Kleibergen-Paap Wald rk F statistic	38.391	63.975	210.689	49.78	79.84	326.92	49.59	79.46	325.35
Partial R squared	0.0083	0.01	0.0252	0.0079	0.0107	0.0267	0.0077	0.0104	0.0262

Note: CQC, DWP and Census, author's own calculations. Table shows OLS and IV results of Equations 1, 2 and 3 for quality deterioration of care homes in catchment areas of 10, 15 and 20 km. All estimations include year and local authority (district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at LSOA level. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Table 6: Effects of closures on total number of inspections in nearby care homes

	Catchment area : 10 km			Catchment area : 20 km		
	Total number of inspections			Total number of inspections		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. OLS	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.334***	0.332***	0.369***	0.341***	0.346***	0.388***
	(0.0421)	(0.0303)	(0.0240)	(0.0330)	(0.0245)	(0.0188)
Observations	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.310	0.312	0.316	0.311	0.314	0.320
Panel B. 2SLS	Total number of inspections			Total number of inspections		
	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.639**	0.361**	0.181**	0.602**	0.348**	0.172**
	(0.312)	(0.176)	(0.0868)	(0.303)	(0.175)	(0.0848)
Observations	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.309	0.313	0.316	0.309	0.314	0.316
Panel C. First Stage	Closure nearest care home within 10 km			Closure nearest care home within 20 km		
	3 months	6 months	12 months	3 months	6 months	12 months
Consolidation	0.115***	0.203***	0.405***	0.115***	0.199***	0.404***
	(0.0111)	(0.0144)	(0.0152)	(0.0109)	(0.0141)	(0.0148)
Kleibergen-Paap Wald rk F statistic	90.95	145.28	708.15	112.07	200.49	744.70
Partial R squared	0.0164	0.0276	0.0607	0.0162	0.0264	0.0601

Note: CQC, DWP and Census, author's own calculations. Table shows OLS and IV results of Equations 1, 2 and 3 for number of quality inspections on care homes managed by the same local authority within catchment areas of 10 and 20 km . All estimations include year and local authority (district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at LSOA level. $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.1$.

Table 7: Effects on informal care

	Proportion of people providing informal care		
	(1)	(2)	(3)
Panel A. OLS	3 months	6 months	12 months
Closure	3.65e-05**	3.64e-05***	4.11e-05***
	(1.75e-05)	(1.35e-05)	(1.06e-05)
Observations	29,900	29,900	29,900
R-squared	0.995	0.995	0.995
Panel B. 2SLS	Proportion of people providing informal care		
	3 months	6 months	12 months
Closure	-0.000165	-0.000109	-5.13e-05
	(0.000199)	(0.000131)	(6.07e-05)
Observations	29,900	29,900	29,900
R-squared	0.995	0.995	0.995
Panel C. First Stage	Closure nearest care home within 5 km		
	3 months	6 months	12 months
Consolidation	0.124***	0.188***	0.399***
	(0.0200)	(0.0235)	(0.0276)
Kleibergen-Paap Wald rk F statistic	38.33	63.65	209.12
Partial R squared	0.00832406	0.01032954	0.02517278

Note: NHS Digital, CQC, DWP and Census, author's own calculations. Table shows OLS and IV results of Equations 1, 2 and 3 for the proportion of people providing informal care over adult population at district level. All estimations include year and local authority (district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at LSOA level. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Table 8: Effects of care home closures on A&E admissions

	Total number of admissions			
	(1)	(2)	(3)	(4)
Panel A. OLS	All ages	Age 70 to 79	Age 80 to 89	Age 90 or more
Closure	-281.8	-191.2	-80.03	-10.58
	(522.6)	(241.2)	(216.6)	(72.34)
Observations	617	617	617	617
R-squared	0.688	0.692	0.686	0.689
Panel B. 2SLS	Closure nearest care home			
	All ages	Age 70 to 79	Age 80 to 89	Age 90 or more
Closure nearest care home	3609	1497	519.8	1592
	(2409)	(982.1)	(328.2)	(1115)
Observations	617	617	617	617
R-squared	0.678	0.677	0.680	0.682
Panel C. First Stage	Closure nearest care home			
Consolidation	0.780***			
	(0.147)			
Kleibergen-Paap Wald rk F statistic	27.94			
Partial R squared	0.0818			

Note: NHS Digital, CQC, DWP and Census, author's own calculations. Table shows OLS and IV results of Equation 4 for number of A&E attendances for old patients with an age range of 70 years old and older. All estimations include year and local authority (district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance, the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit and the existence of a hospital within a catchment area of 5 Km. Robust errors are calculated at LSOA level. $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.1$.

A Theoretical model

To understand the association between the market structure and quality, this section sketches a simple model following Forder and Allan (2014). A care home i has an objective function U that is composed by the profits obtained π and a factor m that characterises their altruistic behaviour and depends positively on the quality of the service. As Brekke et al. (2018) argue this assumption is relevant not only for models on long term care but also in healthcare, education and other sectors in public economics where individuals are mission oriented.

$$U_i(\pi_i, q_i) = \pi_i + m_i(q_i)X_i \tag{5}$$

Taking into account the institutional characteristics discussed in Section 2, the demand (X) for this care home is composed by two types of residents: self-funded (X^s) and publicly funded (X^p). Since self-funded residents value quality q, the price they are willing to pay depends on the level of quality provided. Hence, their price is expressed as $p^s(q_i)$. Also, the prices paid by publicly-funded residents are determined by the local authorities that are only interested in meeting the minimum quality standard so that their prices p^p are exogenous to the levels quality beyond the minimum standard. There are marginal and fixed costs (C_i and F_i respectively) that increase with quality. Considering these aspects it is possible to introduce the profits function and re-define Equation 5 as:

$$U_i = P_i^p X_i^p(q_i, P_i^p) + P_i^s(q_i)X_i^s(q_i, P_i^s) - C(q_i)(X_i^p + X_i^s) - F(q_i) + m_i(q_i)(X_i^p + X_i^s) \tag{6}$$

Maximising the objective function with respect to quality (q_i), we get first-order

condition for care home i:

$$\frac{\partial U_i}{\partial q_i} = P_i^p \frac{\partial X_i^p}{\partial q_i} + (m_i - C_i)\frac{\partial X_i^p}{\partial q_i} + \frac{\partial X_i^s}{\partial q_i} X_i^s + P_i^s \frac{\partial X_i^s}{\partial q_i} + (m_i - C_i)\frac{\partial X_i^s}{\partial q_i} + \\ + \left[\frac{\partial m}{\partial q_i} - \frac{\partial C}{\partial q_i}\right](X_i^s + X_i^p) - \frac{\partial F}{\partial q_i} = 0 \tag{7}$$

The effect of the number of care homes in market (N) on the quality of care home i is obtained by solving Equation 7 for N.

$$\frac{\partial U_i}{\partial q_i \partial N} = \frac{\partial P_i^p}{\partial N}\frac{\partial X_i^p}{\partial q_i} + P_i^p \frac{\partial X_i^p}{\partial q_i \partial N} + \frac{\partial P_i^s}{\partial q_i \partial N} X_i^s + \frac{\partial P_i^s}{\partial q_i}\frac{\partial X_i^s}{\partial N} + \frac{\partial P_i^s}{\partial N}\frac{\partial X_i^s}{\partial q_i} + \\ + P_i^s \frac{\partial X_i^s}{\partial q_i \partial N} + (m_i - C_i)\left[\frac{\partial X_i^p}{\partial q_i \partial N} + \frac{\partial X_i^s}{\partial q_i \partial N}\right] + \left[\frac{\partial m_i}{\partial q_i} - \frac{\partial C_i}{\partial q_i}\right]\left[\frac{\partial X_i^p}{\partial N} + \frac{\partial X_i^s}{\partial N}\right] \tag{8}$$

Since $\frac{\partial P_i}{\partial N} < 0$ and $\frac{\partial X_i}{\partial N} < 0$ the sign of this effect is ambigous and depends on how responsive the demand is with regards to prices. In cases with low price elasticity, the increase in competition may lead to increases in quality (Gaynor & Town, 2011). This would be plausible in cases were prices are regulated such as for example hospitals in England.

B Additional robustness checks

This section presents further analysis and robustness checks in the main specifications considering (i) fixed effects at the level of the local authority with responsibility over long term care (Table 9) and (ii) specifications with errors clustered at MSOA, district and county level (Table 10). Analysis are presented including the quality deterioration as the main outcome variable.

Table 9: Effects of care home closures on quality downgrade (5, 10, 15 and 20Km) - fixed effects at county level

Panel A. 2SLS	Quality deterioration in care home (1 = yes) in..			Quality deterioration in care home (1 = yes) in..			Quality deterioration in care home (1 = yes) in..			Quality deterioration in care home (1 = yes) in..		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.217*	0.144*	0.0672*	0.217*	0.144*	0.0672*	0.133	0.0846	0.0397	0.132	0.0838	0.0393
	(0.113)	(0.0742)	(0.0345)	(0.113)	(0.0742)	(0.0345)	(0.132)	(0.0841)	(0.0384)	(0.132)	(0.0843)	(0.0384)
Observations	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.487	0.489	0.492	0.487	0.489	0.492	0.490	0.491	0.492	0.490	0.491	0.492
Panel B. First Stage	Closure nearest care home within 5 km			Closure nearest care home within 10 km			Closure nearest care home within 15 km			Closure nearest care home within 20 km		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Consolidation	0.122***	0.184***	0.394***	0.122***	0.184***	0.394***	0.119***	0.188***	0.401***	0.119***	0.187***	0.398***
	(0.0198)	(0.0234)	(0.0277)	(0.0198)	(0.0234)	(0.0277)	(0.0170)	(0.0214)	(0.0226)	(0.0169)	(0.0213)	(0.0225)
Kleibergen-Paap Wald rk F statistic	33.273	49.320	106.977	33.273	49.320	106.977	49.41	77.38	313.72	49.24	76.99	312.44
Partial R squared	0.0082	0.0101	0.0248	0.0082	0.0101	0.0248	0.0079	0.0106	0.0268	0.0078	0.0104	0.0263

Note: CQC, DWP and Census, author's own calculations. Table shows IV results of Equation 3 and 2 for number of quality inspections on care homes managed by the same local authority within catchment areas of 5, 10, 15, and 20 km . All estimations include year and local authority (local authority at county level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance, the number of informal carers and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at LSOA level. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Table 10: Effects of care home closures on quality downgrade (5 Km) - different error specifications

	Errors clustered at MSOA level			Errors clustered at local authority - district level			Errors clustered at local authority - county level		
Panel A. 2SLS	Quality deterioration in care home (1 = yes) in..			Quality deterioration in care home (1 = yes) in..			Quality deterioration in care home (1 = yes) in..		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Closure	0.196*	0.129*	0.0609*	0.196	0.129	0.0609	0.196	0.129	0.0609
	(0.117)	(0.0762)	(0.0364)	(0.121)	(0.0816)	(0.0396)	(0.121)	(0.0812)	(0.0393)
Observations	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061	30,061
R-squared	0.493	0.495	0.497	0.493	0.495	0.497	0.493	0.495	0.497
Panel B. First Stage	Closure nearest care home within 5 km			Closure nearest care home within 5 km			Closure nearest care home within 5 km		
	3 months	6 months	12 months	3 months	6 months	12 months	3 months	6 months	12 months
Consolidation	0.124***	0.188***	0.399***	0.124***	0.188***	0.399***	0.124***	0.188***	0.399***
	(0.0207)	(0.0258)	(0.0301)	(0.0269)	(0.0351)	(0.0390)	(0.0270)	(0.0356)	(0.0447)
Kleibergen-Paap Wald rk F statistic	35.66	53.03	176.09	21.25	28.53	104.49	21.25	28.53	104.49
Partial R squared	0.0083	0.0103	0.0252	0.0083	0.0103	0.0252	0.0083	0.0103	0.0252

Note: CQC, DWP and Census, author's own calculations. Table shows IV results of Equation 3 and 2 for number of quality inspections on care homes managed by the same local authority within a catchment area of 5 km . All estimations include year and local authority (local authority at district level) fixed effects as well as several local controls that include the proportion of claimants for Job Seekers Allowance, the proportion of people older than 85, the proportion of claimants for Carers Allowance, the number of informal carers and the number of inspections with a bad outcome (i.e. "Requires improvement" or "Inadequate") at the smallest geographical unit. Robust errors are calculated at MSOA, district and county level. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

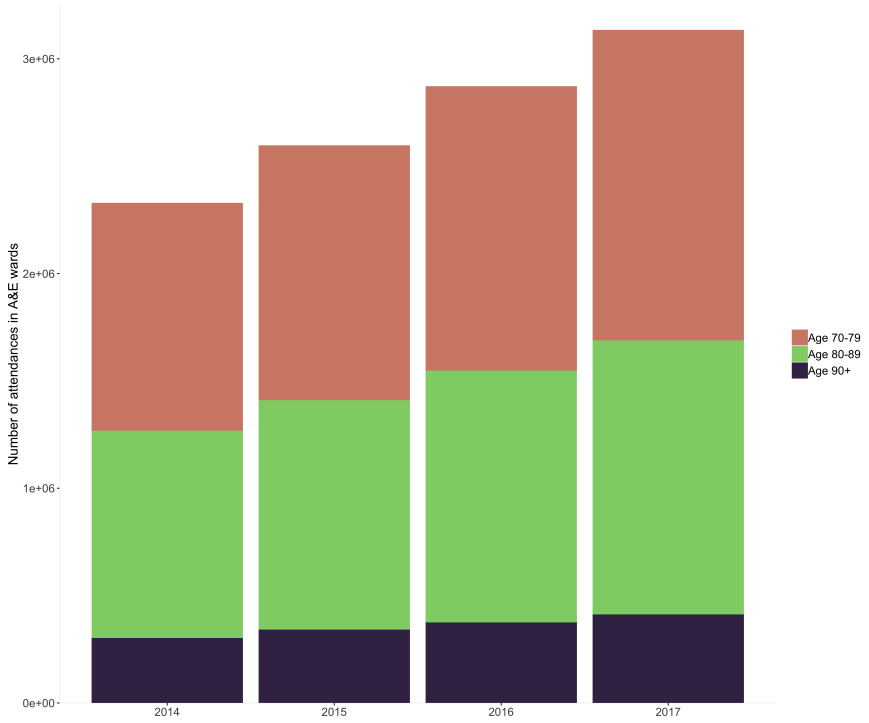
C Data regarding A&E attendances

In this section I describe the data sources used in section 5.4. Data are obtained from the Health Care and Social Care Information Centre (HCSIC) and NHS Digital. The information collected concerns statistics from the Hospital Episode Statistics and the Accident and Emergency statistics.

Data are collected on a fiscal year basis (starting in April) at the level of the health provider (e.g hospitals). The sample of analysis comprises 170 health centres on 137 districts. To calculate the nearest closing care home I use geodesic distance on a similar basis as described in section 3.2 and subset by those care homes that have the minimum distance. The average distance between a closing care home and the nearest hospital acute ward is 1.75 km. The maximum distance is 59.4 km and there are 2 closing care homes that are in the same building as the acute ward. To calculate control hospitals (h in Equation 4), I select the second nearest hospital to the closing care home.

Figure 2 shows the yearly attendances over the period of 2014-2018. There has been an increase in the attendances driven specially by attendances of people within the range of 70-79 years old.

Figure 2: Yearly attendances in A&E wards - England



Note: HSCIC and NHS Digital, author's own calculations. Figures represent A&E attendances for years 2014-2018. Attendances are represented by patient age group.