



Kent Academic Repository

Allan, Stephen and Vadean, Florin (2017) *The impact of workforce composition and characteristics on English care home quality*. Working paper. Personal Social Services Research Unit, Canterbury, Kent, UK (Unpublished)

Downloaded from

<https://kar.kent.ac.uk/63688/> The University of Kent's Academic Repository KAR

The version of record is available from

This document version

Other

DOI for this version

Licence for this version

UNSPECIFIED

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in *Title of Journal*, Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our [Take Down policy](https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies) (available from <https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies>).

The impact of workforce composition and characteristics on English care home quality

Stephen Allan and Florin Vadean

Personal Social Services Research Unit
University of Kent
PSSRU Discussion Paper 2929
September 2017
www.pssru.ac.uk

University of Kent

University of Kent
Cornwallis Building
Canterbury
Kent
CT2 7NF
Tel: 01227 823963
pssru@kent.ac.uk

London School of Economics

London School of Economics
LSE Health & Social Care
Houghton Street
London
WC2A 2AE
Tel: 020 7955 6238
dssru@lse.ac.uk



Economics of
Social and Health Care
Research Unit

Acknowledgements

We would like to thank Skills for Care for sharing with us the National Minimum Dataset for Social Care (NMDS-SC), and Roy Price for helpful assistance on its use. This is an independent report commissioned and funded by the Policy Research Programme in the Department of Health from the Economics of Social and Health Care Research Unit (ESHCRU). ESHCRU is a joint collaboration between the University of York, London School of Economics and University of Kent. The views expressed are those of the authors and may not reflect those of the funders.

1. Introduction

Quality of social care, and how staff impact on the quality of social care provision, are critical policy themes internationally (Wanless *et al.*, 2006; Department of Health, 2010, Department of Health, 2012; Skills for Care, 2014; Colombo and Muir, 2016). Generally, the level of quality in social care in England is well maintained and regulated, but this does not prevent there being high-profile examples of cases of abuse (Cavendish, 2013). Local authorities (LAs) in England are tasked by the Care Act 2014 to shape social care markets in which the continuous improvement of quality is encouraged and where the workforce is able to deliver high quality services. As such, staffing is an important aspect of social care that is likely to impact on the quality of service provided. However, despite this, there is little quantitative evidence for England as to the importance of staff in quality provision within social care.

Social care in general, including care homes, is a highly labour-intensive industry. Currently the UK care home sector has relatively high levels of staff turnover and vacancy rates (Skills for Care, 2015) and there is a potential future workforce shortage (ILC-UK, 2015). Lower fees and employee turnover are putting pressure on care homes so that they are only meeting basic needs and have problems in investing in staff training (National Audit Office, 2014).

The, predominantly US, evidence has generally found that poor workforce characteristics have a significant negative effect on quality indicators (Bostick *et al.*, 2006; Spilsbury *et al.*, 2011). The evidence as to the impact of staffing on social care quality in England/UK is generally descriptive. For example, Hussein *et al.* (2016) examine vacancy and turnover rates in different forms of social care from 2008-2010 and find that there are persistent levels of employee turnover and vacancies in social care which are much higher than national averages. A Royal College of Nursing (2012) report of a survey of nurses working in care homes highlighted that (low) staffing levels and poor skill mix impacted on the level of quality.

This paper seeks to add to the existing evidence for England by providing an empirical analysis of the impact of firm-level workforce composition on the quality of English care homes. We hypothesise that better work conditions (e.g. lower staff turnover, fewer temporary workers) will lead to higher quality in care homes. Specifically, we measure care quality using the quality ratings of the Care Quality Commission (CQC), the national health and social care regulator, and control for care home characteristics and local area supply, demand and need characteristics. We also control for the potential endogenous relationship between care home quality, and both competition and the workforce composition measures.

Section 2 of the paper presents the background of the care homes market, in terms of both the supply and demand for places and the regulation of the market. Section 3 develops the conceptual framework for the analysis, whilst section 4 describes the empirical specification and the data. Section 5 presents the results, with a discussion following in section 6.

2. The English Care Homes Market

The English care homes market for the elderly is composed of just over 9,500 care homes aimed primarily at those who live with dementia or the general population of older people. Much of the supply comprises of single home providers or small multi-home organisations, although there are some large chains. Around 15% of the market is supplied by non-profit providers (Forder and Allan, 2011).

Demand for care home places comes from two main groups, first, publicly-supported residents where services are commissioned by public authorities (local councils) on behalf of service users, and second, self-payers (those who do not qualify for public support). Self-payers make up around 40-45% of demand and, other than a small proportion of placements made by the National Health Service (around 8%, which are without charge to the resident), the remaining placements are made by commissioners in local councils. The self-pay market can be regarded mostly as a conventional market, although all homes, regardless of payer, are required to meet quality standards (see below). The publicly-supported market is a quasi-market (Bartlett *et al.*, 1994). Self-payers have more freedom to choose homes at their preferred price-location/type-quality point, but it is worth noting that most homes currently operate with a mix of self-pay and local authority residents, with an increasing minority now focussing on self-payers only (Laing & Buisson, 2014).

As is seen between public (Medicaid) and private payers in the US nursing home market (Grabowski 2004, Mukamel and Spector, 2002), local authorities appear to have some market power as suggested by the discounts they apparently secure compared to self-pay rates (Office of Fair Trading, 2005; Laing & Buisson, 2014).

Regulation

Care homes are regulated by the Care Quality Commission (CQC), the health and social care regulator for England. Care homes are regulated as to their quality according to their compliance with both the Health and Social Care Act 2008 (Regulated Activities) Regulations 2014 and the Care Quality Commission (Registration) Regulations 2009. The former (from herein the Regulations) deals with the requirements for owners and managers of providers and the fundamental standards which providers must adhere to and not fall below. The latter deals with factors relating to the registration of providers, including the financial position of the provider and statement of purpose (Care Quality Commission, 2015b).

The fundamental standards in the Regulations include no specific requirements as to the number of staff or ratio of skill mix required in English care homes. In particular, Regulation 18 of the Regulations outlines the fundamental standards for staffing and states that:

“[s]ufficient numbers of suitably qualified, competent, skilled and experienced persons must be deployed in order to meet the requirements...”

The Regulations further detail that all staff employed by registered providers must receive training and support to be able to carry out their duties, and be able to further their qualifications in the role they work. In practice, care homes must have a clear plan as to the staffing levels/mix that are present in their care home.

The CQC monitors the performance of providers through local feedback, information gathered from both the provider and national sources, and the inspection and rating of services. Inspections are based around five key questions that ask whether a provider of a residential social care service is: safe, effective, caring, responsive to people’s needs, and well-led. Inspections focus on key lines of enquiry (KLOEs) that are used to consistently assess the five key questions. Care homes are given an overall rating of outstanding, good, requires improvement, or inadequate, and are also rated for each of the five questions using the same scale (Care Quality Commission, 2016). The CQC has significant enforcement powers, which range from requirement notices through to criminal prosecution (Care Quality Commission, 2015a). Any care homes rated as inadequate overall will ordinarily be in breach of regulations and will be placed in to special measures immediately. The home will be monitored closely and re-inspected after six months; if the home shows no significant improvement then the CQC will begin the process to prevent the provider operating the home, i.e. close the care home (Care Quality Commission, 2016).

3. Conceptual framework

For care homes there is both a fixed and variable cost element to quality. At a fixed cost-level, increased quality can be achieved at higher fixed costs, e.g. purpose built care homes (Forder and Allan, 2014). Labour costs form the largest part of variable costs. Laing & Buisson’s ‘Fair price of care’ model for a care home suggests that labour costs would account for 49% and 57% of a fair price for a place in a private, non-London, residential and nursing home, respectively (Laing & Buisson, 2014). Wages have not increased greatly over time in social care but the introduction of the National Living Wage (NLW) in April 2016 (£7.20 per hour) may have increased the share of labour costs in total costs significantly. Indeed, before the introduction of the NLW, almost 70% of care workers aged 25 and over employed by care homes were paid below that rate (see Vadean and Allan, forthcoming).

Standard economic theory suggests a positive, exponential, relationship between quality and costs. To increase quality, costs must also increase, and to achieve ever higher quality costs must increase at a higher rate (e.g. Mussa and Rosen, 1978; Donabedian *et al.*, 1982; Brekke *et al.*, 2010). Mukamel and Spector

(2000) found a U-shaped relationship in New York state nursing homes between quality and costs suggesting that high quality could also be achieved at low cost, by using innovative care protocols and/or management strategies. Nonetheless, other things equal, the more expenditure on care the higher should be the expected quality.

The definition of quality in care homes can generally be separated into two distinct elements: quality of care and quality of life (Osborne, 1992). The former are the technical aspects of care for which the care home is looking after the resident (Wiener, 2003; Malley and Fernandez, 2010; Spilsbury *et al.*, 2011). The latter is individual-based and is concerned with residents' satisfaction with life, including their level of control, privacy, interactions, safety, ability to achieve the activities of daily living, etc. (Wiener *et al.*, 2007; Malley and Fernandez, 2010; OECD/European Commission, 2013). Quality of care will be directly influenced by the competency and quality of care home staff, and, whilst more subjective in nature, quality of life will be indirectly influenced by care home staff. Staff and staffing characteristics in long-term care have an impact on satisfaction (Chou *et al.*, 2003; Lucas *et al.*, 2007) and perceived quality of service (Netten *et al.*, 2007).

The measurement of care quality provided focuses on structure, process and outcome (Donabedian, 1988). The structure of the home includes its characteristics (e.g. size, staff mix) and the characteristics of the residents (payer-type mix). Process refers to the delivery of care, whilst outcome is the result of the care process, in terms of both health outcomes and satisfaction. Staffing is likely to affect all three of these elements. For example, given care homes have to meet the fundamental standards of care and safety, staffing decisions are likely to be part of the structural decision making of the quality set-up of the care home. Issues around maintaining staffing levels, vacancies, turnover, retention and the mix of staff are an indicator of the process of the care home. And, as outlined above, staffing issues will inevitably affect outcomes, and quite possibly *vice versa*. Lower staffing levels compared to the ideal will mean that the quality of care delivered will suffer. Poor quality care may also drive further staff to leave. A large number of new staff may also negatively affect how service is delivered in a care home due to lack of, in economic parlance, specific training. Staff are therefore likely to have a large bearing on the quality of care received in care homes. In this analysis, we focus on the following five factors of workforce composition: 1) staffing levels; 2) vacancy rates; 3) turnover rates/retention rates; 4) share of temporary staff; and 5) nursing ratios (in nursing homes).

Overall staffing levels

An adequate number of staff will be required to perform all necessary tasks within a care home. As described earlier, there is no mandated minimum staffing level and England has large differences in nursing levels and standards for care homes compared to other countries (Harrington *et al.*, 2012). There have been calls for national guidance on staffing levels and ratios (Royal College of Nursing, 2012).

The empirical evidence generally points to increased nursing staff improving quality outcomes. Cawley *et al.* (2006) examined factor substitution in US nursing homes and found that higher wages resulted in fewer staff being employed, increased use of medication, and poorer outcomes. Zhang *et al.* (2008) find that the increased employment of social service and mental health services staff significantly reduced deficiency citations for psychosocial care. However, there are studies that have found no link between staffing levels and quality (e.g. Rantz *et al.*, 2004; Flynn *et al.*, 2010).

The *a priori* expectations on staffing levels will depend on the motives of care home owners. Non-profit care homes should employ a level of staff to maximise the quality of the service, the level of which will depend on the size of the home, and the demographics of the population they serve (needs levels, etc.). For-profit care homes may consider maximising profit, subject to an adequate level of quality to remain in business (Allan and Forder, 2015). However, many 'for-profit' providers, particularly single home or small multi-home organisations, can be regarded as having some non-profit motivation (Matosevic *et al.*, 2000; Knapp *et al.*, 2001; Netten *et al.*, 2001; Kendall *et al.*, 2003).¹ Nonetheless, subject to diminishing marginal returns, the greater the level of staff the higher will be the quality provided.

Hypothesis H1: Increased staffing will improve quality, but at a decreasing rate: $q'(s) > 0$ and $q''(s) < 0$.

Vacancy rates

Vacancy rates are very high in social care (Skills for Care, 2016), and are much higher than national averages (Hussein *et al.*, 2016). There is little empirical evidence as to how vacancy rates impact on the quality of care received in care homes. Chester *et al.* (2014) examined the influence of commissioning and contracting arrangements on staff turnover and vacancies in social care at the local authority-level in the UK. Also pertinent to vacancies is the economic literature of skills shortages (Green *et al.*, 1998). Any shortage of skills identified by firms will inevitably mean that either there is a gap in the workforce, or a lower-skilled, and less productive, employee is fulfilling the role. There is evidence of a significant negative impact of skills shortages on productivity (Haskell and Martin, 1993). Shortages of staff are also play an important role for care home closures in the UK (Netten *et al.*, 2003). Therefore, we proceed with the expectation that vacancies in care homes are likely to increase pressure on existing members of staff, which could lead to lower care quality provision.

Hypothesis H2: Increased vacancy rates will lower quality: $q'(v) < 0$.

¹ McDonald *et al.* (2013) find that US for-profit nursing homes were no more likely to receive deficiency citations for staffing than not-for-profits, although chain membership did significantly increase the probability of staffing deficiency citations.

Staff turnover/retention

Relationships form a key part of care home life (Brown Wilson *et al.*, 2009). We would therefore expect retention and turnover of staff to have opposite effects on care home quality. Retention of staff is important so as to maintain the carer-resident relationship, whereas a high turnover of staff will lead to a breakdown of this care continuity. Additionally, a good retention of staff will also suggest a good quality employer with room for progression or at least fulfilment in roles, high turnover of staff the opposite.

There is evidence that staffing stability will impact on care home quality. The Royal College of Nursing (2012) reported that a high level of turnover can lead to an inappropriate skill mix in care homes. Low *et al.* (2015) found that high workload and high employee turnover negatively impacts on staff attitudes towards quality. Eaton (2000) finds descriptive evidence of high turnover being linked to low quality care from observatory fieldwork and case studies of 20 nursing homes in California and Pennsylvania. Finally, Chou *et al.* (2003) use structural equation modelling to find that resident satisfaction in Australian nursing homes and hostels (residential care) was significantly improved by staff satisfaction levels, the effect being stronger in the former homes. Staff satisfaction and employee turnover have been found to be inversely related (Cotton and Tuttle, 1986; Clark, 2001).

Both turnover and retention are included as it could be possible that they do not capture the same elements of staff stability. For example, a provider with high retention of staff may nonetheless have a high turnover resulting from consistent movement of staff in a few job roles (e.g. Barry *et al.*, 2005).

Hypothesis H3: A high retention of staff will improve quality: $q'(r) > 0$.

Hypothesis H4: A high level of staff turnover will decrease quality: $q'(t) < 0$.

Temporary workforce rates

Closely linked to turnover and vacancies is the use of temporary staff, and particularly agency staff. If temporary staff are being employed then they are likely filling a gap in the staffing of a care home that could not readily be filled. A greater number of staff should therefore improve quality. However, the use of temporary staff may also have negative connotations. Residents may not know the people they are engaging with in their own (care) home. If agency staff are behaving more pragmatically in their role, concentrating on the task at hand rather than focusing on the relationship, then this could impact on the resident's experience (Brown Wilson and Davies, 2009). A care home may specifically decide against using temporary staff for this reason, but this in turn may place greater pressure on existing staff (e.g. Royal College of Nursing, 2012).

The use of agency staff has been investigated in the US. Xue *et al.* (2012) descriptively examined differences between agency (and temporary) nurses and permanently employed nurses and found that the proportion

of agency and temporary nurse working in long term health settings, including nursing homes, fell over time. Bourbonniere *et al.* (2006) show descriptively that nursing homes employing a greater than 5% level of contract nursing staff, which include, but are not solely, agency staff, were much more likely to have high levels of deficiency citations indicating lower quality..

Castle and Engberg (2008a) found that agency staff had significant negative effects on measures of quality, including increased physical restraint use, but that for agency registered nurses there were both positive and negative impacts on quality measures. Indeed, Castle and Engberg (2008b) took this further and found that the employment of agency registered nurses improved a single quality variable statistically generated from 14 measures of quality in 1,071 US nursing homes. Employing agency licensed practice nurses or nursing assistants did not improve quality, but they also found significant interaction effects including a positive one between regular registered nursing employees and agency nursing assistants.

We therefore proceed with the tentative expectation that the prevalence of temporary staff employed by a care home will negatively impact on quality.

Hypothesis H6: The higher the proportion of temporary staff in a care home the lower the quality: $q'(a) < 0$.

Nursing ratios

Generally, there is a positive relationship between the employment of nursing staff and care home quality (Dellefield *et al.*, 2015). For example, Konetzka *et al.* (2008) use data on nursing homes from 5 US states before and after the introduction of a prospective payment system to estimate the impact of registered nurse staffing and skill mix on two (negative) measures of outcome, urinary tract infections (UTIs) and pressure sores. Their results suggest that the amount of registered nurse hours has a negative effect on the level of UTIs and pressure sores, and that higher skill mix only has a significant negative impact on UTIs. There is also evidence that a lack of registered nursing staff leads to increased hospitalisation rates (e.g. Kayser-Jones *et al.*, 1989; Carter & Porell, 2003). We therefore expect that the higher the prevalence of registered nursing staff in a care home, the higher will be the quality.

Hypothesis H7: The higher the proportion of registered nurses in a care home the higher the quality: $q'(n) > 0$.

4. Data and methodology

Data

We use the National Minimum Dataset for Social Care (NMDS-SC) as of April 2016. The NMDS-SC is an online database of the adult social care workforce for England, and is used as the main source of workforce intelligence by the Government and LAs. The NMDS-SC is managed by Skills for Care on behalf of the Department of Health. Data kept on the NMDS-SC is maintained by providers who voluntarily register. Each worker entered on to the NMDS-SC is provided with a unique identification number so that they cannot be identified. Skills for Care offer free advice and support to providers via phone and online, and the use of the NMDS-SC comes with a number of benefits including: personalised reports, planning workforce decisions, track staffing, compare to local and regional providers, apply for funding for training, and access to online training modules. In addition, provider data held on the NMDS-SC can automatically be used to update the staffing section of their Provider Information Return (PIR), which is a legally required document as part of the inspection and monitoring process for all social care providers regulated by the CQC (Care Quality Commission, 2015c).

NMDS-SC is the only nationwide source of social care staffing data. However, there are weaknesses to this data. First, data is provided voluntarily and so not all providers will be involved. Nonetheless, the NMDS-SC has information on a large proportion of social care establishments, more than 22,000 out of an estimated 39,500 establishments across the country (Skills for Care, 2015). Second, the data provided is from the provider, and so it is not validated as to its reliability. However, as stated above data held on the NMDS-SC can be used to complete a section of a provider's PIR, and the data held can be used by the CQC to inform inspectors as part of their intelligent monitoring process if a provider allows for this. The large majority (83%) of providers with data on the NMDS-SC allow their data to be used by the CQC.²

Skills for Care provided an anonymised provider database for April 2015 and April 2016, the latter with CQC quality ratings matched to providers (where they had been rated). The April 2016 provider database has 22,088 providers across all forms of social care. Of these 5,083 were independent sector care homes where at least some of the residents were older people or older people suffering with dementia. However, not all of the entries are kept current. As such, we restricted the analysis to those establishments that had entered data in the last calendar year up to April 2016, leaving 3,496 care homes (68.78%). The analysis uses time-lagged values of staffing characteristics as appropriate instruments and so requires a care home to have updated their information in the calendar year to April 2015 to be included. This leaves 2,516 care homes

² See <http://www.skillsforcare.org.uk/Document-library/NMDS-SC,-workforce-intelligence-and-innovation/NMDS-SC/CQC-NMDS-Data-Use-v7-FINAL.pdf>.

for the analysis. As well as information on staffing levels, the dataset has information on the type of care home (nursing or residential), the sector (private or voluntary), the region where the care home is located in England, and number of beds.

The measures of staffing characteristics are as follows. Total staff is the total number of permanent and temporary staff employed at the establishment. The vacancy rate is calculated as the total number of vacancies to the total number of staff. The turnover rate is calculated as the total number of staff who left the establishment to the total number of staff 12 months earlier, and similarly the retention rate is the total number of staff retained at the establishment in the last 12 months to the total number of staff 12 months earlier. The rate of temporary, pool and agency staff is calculated as the number of direct care staff that are either pool, agency, or on temporary contracts to the total number of direct care staff. The nursing ratio for nursing homes is calculated as the rate of registered nurses to the total of non-management staff.

Local area characteristics were matched to the dataset using geographical identifiers held in the database. Specifically, measures of need, demand and supply were matched to providers at LA-level (n=152) and postcode district-level (n=2,302), which is the lowest level of geography available.³ For need and demand the percentage of people who provided unpaid care, the percentage of people reporting their health as bad (both from 2011 census data), the percentage receiving pension credit and the percentage receiving Disability Living Allowance (DLA) were used, all at the postcode district level.⁴ At supply level, the percentage of females receiving job seekers' allowance, the percentage of females with no qualifications, both at postcode district level, and LA-level average house price were used. In addition, a measure of competition at the postcode district level was also included. This is a Herfindahl-Hirschman Index (HHI) measure of competition for every care home for the elderly in the CQC register of care homes for April 2016, measured using a 10km radius around the home following the method of Forder and Allan (2014), where 0 indicates perfect competition and 1 indicates monopoly. The postcode-district average of the HHI for each care home was matched to the final dataset.

Descriptive statistics are provided in Table 1. Staff-wise, the average elderly care home has a staff of 47 people with an average size of 40 beds. Vacancy rates are higher than the national average. The average turnover rate of 26% and retention rate of 75.5% shows that care homes have trouble retaining staff. Despite this, there is still only a small percentage of pool, agency and temporary workers employed. Finally, for nursing homes around 1 in every 7 non-management staff are registered nurses on average.

³ For anonymity reasons, the full postcode was not available. The postcode district is the first half of a full postcode (e.g. SW1).

⁴ Pension credit is an income-based benefit available for those who qualify for the state pension and Disability Living Allowance is a benefit for adults that need help with mobility or care costs.

As might be expected, the voluntary sector is slightly over-represented and the nursing sector is under-represented. The current CQC quality rating system began in October 2014 and by April 2016 1,675 of the 2,516 care homes had been rated. Of these, around two thirds were classed as good or outstanding.

<Table 1 about here>

Multiple Imputation

Because of the large number of homes that have yet to be rated by the CQC, and given there is some high levels of missing staffing characteristics data, we assume that the data are missing at random and use multiple imputation (MI) to give predicted values for the homes with data missing. To generate 20 imputations, we implemented a chained imputation method with logit and predictive mean matching models.

Model

We can assume that for all care homes in England there is an underlying latent quality variable, Q^* , which indicates the propensity that a care home will be rated as good or excellent following a CQC inspection. This can be described by the following:

$$Q_{ij}^* = \alpha_{ij} + \beta S_{ij} + \delta X_{ij} + \varepsilon_{ij}$$

The quality of care home i in postcode district j is dependent on a vector of staffing characteristics, S , a vector of care home- and local-level need, demand and supply measures, X , and a random error term, ε . The relationship between Q^* and q , the observed CQC quality rating, is explained in the following way:

$$q = 1 \text{ if } Q_{ij}^* > 0$$

$$q = 0 \text{ if } Q_{ij}^* \leq 0$$

Where q takes a value of 1 for homes that are rated as good or excellent and a value of 0 for homes rated as inadequate or requires improvement.

It is likely that both competition and staff characteristics are endogenous to quality ratings, be it an omitted variable bias or simultaneity between quality ratings and competition/staff characteristic. For example, Castle (2013) finds that nursing homes where staff were consistently assigned to the same care recipient have lower turnover and absenteeism, and Bowblis (2011) shows that state federally mandated minimum staffing levels led to higher levels of staff and higher quality. As an example of simultaneity, Hayes *et al.* (2012) find that nurse turnover was impacted by the quality of care provided. As such, the estimation procedure used is a two-stage probit model of the binary measure of quality. In the first stage instruments

are included in a regression of the endogenous independent variable, and then the predicted value of the endogenous variable is included in the second stage probit regression of quality.

We use spatial- and time-lag instruments to control for potential endogeneity. For the staff measures, we use the (one year) lagged value of each staffing measure combined with a higher-level geography measure of local employment conditions – the percent of women claiming job seekers' allowance (JSA) at LA-level. For competition the instruments used follow that of Forder and Allan (2014), which are measures of need and demand at higher level geographies – the percent of older people (65+) claiming pension credit and the percent of the population claiming Disability Living Allowance (DLA), both at LA level. All spatial instruments exclude the values from the lower level geography that the care home is located in, i.e. postcode district, and the postcode district-level measures are included in both stages of the regression analysis.

5. Results

The approach for testing the adequacy and use of the instruments given the use of multiple imputation follows that outlined in Allan and Forder (2015). Briefly, weak instruments are assessed using an MI F-test of the instruments when included in a regression of staffing characteristics and competition with all independent variables also included. Residuals from these first stage regressions were included in probit regressions of quality ratings and the significance of the residuals was used to test for endogeneity. Finally, over-identification was assessed by including the instruments in a regression of the residuals from the second stage and using MI F-tests to assess the significance of the instruments. All instruments passed MI F-tests in the first stage regressions and there was also no indication of overidentification for any of the instruments. However, whilst there was no sign of endogeneity for competition or any of the other staffing variables, there is an indication that both vacancy rate and nursing ratio were endogenous variables (the former at 10% significance level).

Table 2 reports in the first column the results of a basic MI probit model, in the second column a MI probit model where vacancy rate is instrumented to control for endogeneity and the final column presents a MI probit model for nursing homes only where both vacancy rates and nursing ratio are instrumented.⁵ As found in previous analyses, competition reduces quality in care homes, voluntary care homes have significantly higher quality, and nursing homes significantly lower quality. The size of the home does not impact on the quality rating. For staffing characteristics, the results suggest that overall staff size does not significantly impact on care home quality. Vacancy rates and retention rates have a significant effect on

⁵ The results of the first stage regressions for each potential endogenous variable are presented in the appendix.

care home quality, in the expected directions. Turnover rates and the level of pool, agency and temporary staff have no significant impact on care home quality. When looking at only nursing homes in Table 3 the results suggest that the level of registered nurses does not have a significant positive effect on care home quality.

<Table 2 about here>

The marginal effects of staffing characteristics on quality are presented in Table 3 for the three models of Table 2. Looking at the preferred results where vacancy rates are instrumented, a one percentage point increase in vacancy rate and retention rate would lead to a 1.6% decrease and a 0.3% increase in the probability of the average care home being rated as good or excellent, respectively. For nursing homes, the effect of vacancy rates on quality ratings is even stronger.

We perform a number of specification checks. First, we run the probit analysis on the complete cases. Second, a multiple imputation probit regression is run for all care homes that updated information held on the NMDS-SC in the calendar year to April 2016 (n=3,496). Third, some care homes were rated prior to when their staffing data was updated on NMDS-SC. To confirm that this does not affect the results, we run the analysis only for care homes that were rated by the CQC after their staffing characteristics had been updated. Only in the latter do the results differ from the main analysis, with retention rate no longer significantly affecting quality rating. Finally, for pool, agency and temporary workers a binary variable indicating a high level of these staff (greater than 5%) was also not significant.

<Table 3 about here>

6. Discussion

The findings suggest that local workforce characteristics do have a significant impact on quality. In particular, vacancies and levels of retention impact on the probability of a care home being rated as good or excellent from CQC inspections. Having vacancies in a care home will mean increased working pressure for existing staff and dilutes the amount of effort an individual staff member can give to any resident. This result fits with the findings of the Royal College of Nursing (2012) report of a survey of registered nurses which found that many felt they could not adequately deliver the quality they wanted to in their role because of staff shortages. Higher retention rates will mean better quality is delivered, and has a stronger (absolute) effect on quality than turnover rates. This finding is suggestive that tenure at a care home is important, that there is job-specific training and knowledge which is pertinent to how successful care home staff are in delivering high quality outcomes for residents. Continuity of caregivers for residents is

undoubtedly important, but perhaps less so in determining care home quality given that turnover rates do not have such a significant impact on quality ratings.

There was no significant impact on quality of the prevalence of temporary staff. The use of pool and agency staff is fairly low in care homes and is much higher in other parts of social care. Nonetheless, this finding, combined with that of vacancy rates, suggests that having the correct level of staffing is very important for care homes. It would also suggest that care home providers are good at training their short-term staff.

The marginal effects found were not large in an absolute sense. However, this masks that care homes that have large changes to their staffing circumstances could find their quality affected to a great extent. For instance, the average care home having an increase in vacancy rate from the mean level to the 90th percentile level (8.0%), equivalent to 2.6 extra vacancies each year at mean staffing levels, would have a 9.1% decrease in the probability of being rated as good or excellent. Similarly, a care home that was able to improve their retention rate from the 10th percentile level (46.0%) to the mean level, equivalent to 13 extra staff members being retained, would be 9.9% more likely to be rated as good or excellent.

There has been no previous quantitative results for England as to the impact that staffing has on care home quality and so this is an important finding for policy. Care providers are currently facing both income pressures as a result of the continued climate of public sector spending reductions and cost pressures due to the introduction of the new National Living Wage. These pressures may push care home providers to employ a bare minimum level of staffing. For example, US evidence shows that cuts to reimbursement payments resulted in fewer staff (e.g. Konezka *et al.*, 2004; Unruh *et al.*, 2006). Low wages, and a stressful working environment with too few staff, would further reduce incentives for staff to remain with a provider, or even within the industry when alternative low-wage, but lower pressure, jobs are usually available, e.g. retail industry. A four-year national retention and recruitment strategy for social care was implemented in 2014 (Skills for Care, 2014). The results of this paper suggest that a continuation of this policy would be highly beneficial.

Currently a large proportion of care home staff come from overseas. In 2016 7% of social care staff were from the EU and 11% were from outside the EU, and this varies by region to a large extent (Skills for Care, 2016).⁶ There are therefore concerns about the impact on care home staffing of the decision by the UK to leave the EU given a large proportion of staff are of EU nationality (e.g. McKenna, 2016). Additionally, changes to immigration laws have made it difficult for low-paid immigrants to be granted indefinite leave

⁶ This rate of non-British staff is also much higher than most industries. See: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/adhocs/005196thenationalityofworkersinemploymentintheukbyindustrysector2015>

to remain in the UK (e.g. Allan, 2015).⁷ All of these issues point to increased pressures in recruiting and retaining staff. Therefore, policy to help encourage longevity in post would be useful in promoting a stronger, higher quality, care homes market.

A number of specification checks were performed but there are still some caveats to the findings. First, the results are based on a cross-section and only confirm a correlation between quality and workforce characteristics. Any causation would have to be examined using a longitudinal analysis. Second, the results use data that is provided by the care homes themselves. The quality of this data cannot therefore be assessed, but we argue to its veracity. Third, care home quality has been measured using CQC quality ratings, and so these may not reflect individual resident outcomes within care homes. However, previous CQC star ratings have been found to be positively related to social care related quality of life (Netten *et al.*, 2012) and the underlying basis of the current CQC quality rating system is the 'Mum Test' which asks if someone would be happy with the services provided if their mother lived in the care home.⁸ Therefore, it seems likely that CQC quality ratings will reflect individual outcomes, at least to some extent.

Finally, the instruments for the staffing variables were taken from earlier data. Some pause may be required since it has been shown that there are issues with using time-lags as instruments (Bellemare *et al.*, 2015; Reed, 2015). Future research in this area may need to consider alternative instruments, but, even so, the findings of the paper are generally consistent across all estimation processes.

⁷ Although note that nurse is an occupation currently on the shortage occupation list and so this does not apply.

⁸ <http://www.cqc.org.uk/content/making-mum-test-real-cqc-sets-out-its-new-model-inspecting-adult-social-care>

References

Allan, S. Implications of the Care Act 2014 on social care markets for older people. In *Unit Costs of Health and Social Care 2015*, Curtis, L. & Burns, A. (Eds.), 2015, PSSRU, University of Kent, Canterbury

Allan, S. & Forder, J. (2015) The determinants of care home closure, *Health Economics*, 24, S1, 132-145.

Barry, T., Brannon, D., & Mor, V. (2005) Nurse Aide Empowerment Strategies and Staff Stability: Effects on Nursing Home Resident Outcomes, *The Gerontologist*, 45 (3) pp309-317

Bartlett, W., Propper, C., Wilson, D., Le Grand, J. (Eds.) (1994) *Quasi-Markets in the Welfare State*. SAUS Publications, Bristol.

Bellemare, M.F., Masaki, T. & Pepinsky, T.B. (2015). Lagged Explanatory Variables and the Estimation of Causal Effects. Available at SSRN: <http://ssrn.com/abstract=2568724>.

Bostick, J.E., Rantz, M.J., Flesner, M.K., & Riggs, C.J. (2006) Systematic Review of Studies of Staffing and Quality in Nursing Homes, *Journal of the American Medical Directors Association*, 7 (6), 366–376.

Bourbonniere, M., Feng, Z., Intrator, O., Angelelli, J., Mor, V., & Zinn, J.S. (2006) The Use of Contract Licensed Nursing Staff in U.S. Nursing Homes, *Medical Care Research and Review*, Vol. 63 No. 1, 88-109.

Bowblis, J.R. (2011) Staffing Ratios and Quality: An Analysis of Minimum Direct Care Staffing Requirements for Nursing Homes, *Health Services Research* 46:5, 1495-1516.

Brekke, K.R., Siciliani, L., & Straume, O.R. (2010) Price and quality in spatial competition, *Regional Science and Urban Economics*, 40, 471–480.

Brown Wilson, C. & Davies, S. (2009) Developing relationships in long term care environments: the contribution of staff, *Journal of Clinical Nursing*, 18, 1746–1755.

Brown Wilson, C., Davies, S., & Nolan, M. (2009) Developing personal relationships in care homes: realising the contributions of staff, residents and family members, *Ageing and Society*, 29 (07), 1041-1063.

Care Quality Commission (2015a) *Enforcement policy*, Care Quality Commission, Newcastle.

http://www.cqc.org.uk/sites/default/files/20150209_enforcement_policy_v1-1.pdf

Care Quality Commission (2015b) *Guidance for providers on meeting the regulations: Health and Social Care Act 2008 (Regulated Activities) Regulations 2014 (Part 3) (as amended) and Care Quality Commission (Registration) Regulations 2009 (Part 4) (as amended)*, Care Quality Commission, Newcastle.

http://www.cqc.org.uk/sites/default/files/20150324_guidance_providers_meeting_regulations_01.pdf

Care Quality Commission (2015c) How to complete the provider information return (PIR): Residential care, Care Quality Commission, Newcastle.

https://www.cqc.org.uk/sites/default/files/20150121_900254_v5_00_pir_residential_guidance_roll_out_2.pdf

Care Quality Commission (2016) How CQC regulates: Residential adult social care services, Provider handbook, Care Quality Commission, Newcastle.

http://www.cqc.org.uk/sites/default/files/20160422_ASC_residential_provider_handbook%20April_2016_update.pdf

Carter, M.W. & Porell, F.W. (2003) Variations in Hospitalization Rates Among Nursing Home Residents: The Role of Facility and Market Attributes, *The Gerontologist*, Vol. 43, No. 2, 175–191.

Castle, N.G. & Engberg, J. (2008a) Further Examination of the Influence of Caregiver Staffing Levels on Nursing Home Quality, *The Gerontologist*, Vol. 48, No. 4, 464–476.

Castle, N.G. & Engberg, J.B. (2008b) The Influence of Agency Staffing on Quality of Care in Nursing Homes, *Journal of Aging & Social Policy*, 20:4, 437-457.

Castle, N.G. (2013) Consistent Assignment of Nurse Aides: Association With Turnover and Absenteeism, *Journal of Aging & Social Policy*, 25:1, 48-64.

Cavendish, C. (2013) An independent review into healthcare assistants and support workers in the NHS and social care settings. Department of Health, London.

Cawley, J., Grabowski, D.C., & Hirth, R.A. (2006) Factor substitution in nursing homes, *Journal of Health Economics*, 25, 234–247.

Chester, H., Hughes, J., & Challis, D. (2014) Commissioning social care for older people: influencing the quality of direct care, *Ageing and Society*, 34 (06), pp930-950.

Chou, S-C., Boldy, D.P., & Lee, A.H. (2003) Factors Influencing Residents' Satisfaction in Residential Aged Care, *The Gerontologist*, Vol. 43, No. 4, 459–472.

Clark, A.E. (2001) What really matters in a job? Hedonic measurement using quit data, *Labour Economics* 8, 223–242.

Colombo, F. and Muir, T (2016) Developing a skilled long-term care workforce, in Gori, C, Fernandez, J-L & Wittenberg, R., Eds., *Long Term Care reforms in OECD countries*, Policy Press, Bristol

- Cotton, J.L. & Tuttle, J.M. (1986) Employee turnover: A meta-analysis and review with implications for research, *Academy of Management Review*, 11:1, 55-70.
- Dellefield, M.E., Castle, N.G., McGilton, K.S., & Spilsbury, K. (2015) The relationship between registered nurses and nursing home quality: An integrative review (2008-2014), *Nursing Economics*, 33(2), 95-108.
- Department of Health (2010) *A Vision for Adult Social Care: Capable Communities and Active Citizens*. Crown copyright, London.
- Department of Health (2012) *Caring for our future: reforming care and support*. Crown copyright, London.
- Donabedian, A., Wheeler, J.R.C., & Wyszewianski, L. (1982) Quality, Cost, and Health: An Integrative Model, *Medical Care*, Vol. 20, No. 10, pp. 975-992.
- Donabedian, A. (1988) The Quality of Care: How Can It Be Assessed? *Journal of American Medical Association*, 260(12), 1743-1748.
- Eaton, S.C. (2000) Beyond 'unloving care': linking human resource management and patient care quality in nursing homes, *The International Journal of Human Resource Management*, 11:3, 591-616.
- Flynn, L., Liang, Y., Dickson, G.L., & Aiken, L.H. (2010) Effects of Nursing Practice Environments on Quality Outcomes in Nursing Homes, *Journal of American Geriatrics Society*, 58(12), 2401-2406.
- Forder, J. and Allan, S. (2011) *Competition in the care homes market*. Report for the OHE Commission on Competition in the NHS. Office of Health Economics, London.
- Forder, J. & Allan, S. (2014) The impact of competition on quality and prices in the English care homes market, *Journal of Health Economics*, 34, 73-83.
- Grabowski, D.C. (2004) A longitudinal study of Medicaid payment, private-pay price and nursing home quality. *International Journal of Health Care Finance and Economics* 4 (1), 5–26.
- Green, F., Machin, S., Wilkinson, D. (1998) The meaning and determinants of skills shortages, *Oxford Bulletin of Economics and Statistics*, 60(2), 165-187.
- Harrington, C., Choiniere, J., Goldmann, M., Jacobsen, F.F., Lloyd, L., McGregor, M., Stamatopoulos, V., & Szebehely, M. (2012) Nursing Home Staffing Standards and Staffing Levels in Six Countries, *Journal of Nursing Scholarship*, 44:1, 88-98.
- Haskell, J. & Martin, C. (1993) Do skill shortages reduce productivity? Theory and evidence from the United Kingdom, *Economic Journal*, 103, 386-394.

- Hayes, L.J., O'Brien-Pallas, L., Duffield, C., Shamian, J., Buchan, J., Hughes, F., Spence Laschinger, H.K., & North, N. (2012) Nurse turnover: A literature review – An update, *International Journal of Nursing Studies*, 49, 887–905.
- Hussein, S. & Manthorpe, J. (2012) The dementia social care workforce in England: Secondary analysis of a national workforce dataset, *Aging & Mental Health*, 16(1), 110-118.
- Hussein, S., Ismail, M., & Manthorpe, J. (2016) Changes in turnover and vacancy rates of care workers in England from 2008 to 2010: panel analysis of national workforce data, *Health and Social Care in the Community*, 24(5), 547–556.
- ILC-UK (2015) *The end of formal adult social care*. ILC-UK, London.
- Kayser-Jones, J.S., Wiener, C.L., and Barbaccia, J.C. (1989) Factors Contributing to the Hospitalization of Nursing Home Residents, *The Gerontologist*, 29 (4): 502-510.
- Kendall, J., Matosevic, T., Forder, J., Knapp, M., Hardy, B., & Ware, P. (2003) The motivation of domiciliary care providers in England: new concepts, new findings. *Journal of Social Policy* 32 (4), 489–512.
- Konetzka, R.T., Yi, D., Norton, E.L., & Kilpatrick, K.E. (2004) Effects of Medicare payment changes on nursing home staffing and deficiencies. *Health Services Research*, 39(3), 463–488.
- Konetzka, R.T., Stearns, S.C., & Park, J. (2008) The Staffing–Outcomes Relationship in Nursing Homes, *Health Services Research*, 43:3, 1025-1042.
- Knapp, M., Hardy, B., & Forder, J. (2001) Commissioning for quality: ten years of social care markets in England. *Journal of Social Policy* 30 (2), 283–306.
- Laing & Buisson (2014) *Care of older people: UK market report 2013/2014*, 26th Edition. Laing & Buisson, London.
- Low, L-F., Fletcher, J., Goodenough, B., Jeon, Y-H., Etherton-Ber, C., MacAndrew, M., & Beattie, E. (2015) A Systematic Review of Interventions to Change Staff Care Practices in Order to Improve Resident Outcomes in Nursing Homes, *PLoS ONE* 10(11): e0140711. doi:10.1371/journal.pone.0140711
- Lucas, J.A., Levin, C.A., Lowe, T.J., Robertson, B., Akincigil, A., Sambamoorthi, U., Bilder, S., Paek, E.K., & Crystal, S. (2007) The Relationship Between Organizational Factors and Resident Satisfaction with Nursing Home Care and Life, *Journal of Aging & Social Policy*, 19:2, 125-151.
- Malley, J. & Fernandez, J-L. (2010) Measuring quality in social care services: Theory and practice, *Annals of Public and Cooperative Economics*, 81:4, 559–582.

- Matosevic, T., Kendall, J., Forder, J., Knapp, M., Hardy, B., & Ware, P. (2000) The Motivations of Domiciliary Care Providers. PSSRU, London School of Economics.
- McDonald, S.M., Wagner, L.M., & Castle, N.G. (2013) Staffing-Related Deficiency Citations in Nursing Homes, *Journal of Aging & Social Policy*, 25:1, 83-97.
- McKenna, H. (2016) Five big issues for health and social care after the Brexit vote. The King's Fund. Available at: <https://www.kingsfund.org.uk/publications/articles/brexit-and-nhs>
- Mukamel, D.B., & Spector, W.D. (2000) Nursing Home Costs and Risk-Adjusted Outcome Measures of Quality, *Medical Care*, Vol. 38, No. 1, 78-89.
- Mukamel, D.B., Spector, W.D. (2002) The competitive nature of the nursing home industry: Price mark ups and demand elasticities, *Applied Economics* 34 (4),413–420.
- Mussa, M. and Rosen, S. (1978), 'Monopoly and Product Quality', *Journal of Economic Theory*, 18: 2, 301-317.
- National Audit Office (2014) Adult social care in England: overview. National Audit Office, London.
- Netten, A., Darton, R., Bebbington, A., Brown, P. (2001) Residential or nursing home care? The appropriateness of placement decisions. *Ageing and Society* 21,3–23.
- Netten, A., Darton, R., & Williams, J. (2003) Nursing home closures: effects on capacity and reasons for closure, *Age and Ageing*, 32:3, 332–337.
- Netten, A., Jones, K., & Sandhu, S. (2007) Provider and Care Workforce Influences on Quality of Home-Care Services in England, *Journal of Aging & Social Policy*, 19:3, 81-97.
- Netten, A., Trukeschitz, B., Beadle-Brown, J., Forder, J., Towers A., & Welch, E. (2012) Quality of life outcomes for residents and quality ratings of homes: is there a relationship? *Age and Ageing*, 41(4), 512-517.
- OECD/European Commission (2013) A Good Life in Old Age? Monitoring and Improving Quality in Long-term Care. OECD Health Policy Studies, OECD Publishing. <http://dx.doi.org/10.1787/9789264194564-en>
- Office of Fair Trading (2005) Care Homes for Older People in the UK: A Market Study. OFT, London.
- Osborne, S.P. (1992) The Quality Dimension. Evaluating Quality of Service and Quality of Life in Human Services, *British Journal of Social Work*, 22, 437-453.

- Rantz, M.J., Hick, L., Grando, V., Petroski, G.F., Madsen, R.W., Mehr, D.R., Conn, V., Zwygart-Staffacher, M., Scott, J., Flesner, M., Bostick, J., Porter, R., & Maas, M. (2004) Nursing Home Quality, Cost, Staffing, and Staff Mix, *The Gerontologist*, Vol. 44, No. 1, 24–38.
- Reed, W.R. (2015) On the Practice of Lagging Variables to Avoid Simultaneity, *Oxford Bulletin of Economics and Statistics*, 77(6), 897-905.
- Royal College of Nursing (2012) Persistent challenges to providing quality care: An RCN report on the views and experiences of frontline nursing staff in care homes in England. Royal College of Nursing, London.
- Skills for Care (2014) Adult social care workforce recruitment and retention strategy, 2nd edition. Skills for Care, Leeds.
- Skills for Care (2015) The state of the adult social care sector and workforce in England, 2014. Skills for Care, Leeds.
- Skills for Care (2016) The state of the adult social care sector and workforce in England, 2016. Skills for Care, Leeds.
- Spilsbury, K., Hewitt, C., Stirk, L., & Bowman, C. (2011) The relationship between nurse staffing and quality of care in nursing homes: A systematic review, *International Journal of Nursing Studies*, 48, 732–750.
- Unruh, L., Zhang, N.J. & Wan, T.T.H. (2006) The impact of Medicare reimbursement changes on staffing and the quality of care in nursing homes, *Int. J. Public Policy*, Vol. 1, No. 4, pp.421–434.
- Vadean, F. & Allan, S. (Forthcoming) The Effects of minimum wage policy on the long-term care sector, PSSRU Discussion Paper 2932. PSSRU, Canterbury.
- Wanless, D., Forder, J., Fernandez, J.-L., Poole, T., Beesley, L., Henwood, M., Moscone, F., 2006. *Securing Good Care for Older People: Taking a Long Term View*. King's Fund, London.
- Wiener, J.M. (2003) An Assessment of Strategies for Improving Quality of Care in Nursing Homes, *The Gerontologist*, Vol. 43, Special Issue II, 19–27.
- Wiener, J.M., Freiman, M., & Brown, D. (2007) Strategies for improving the quality of long-term care. RTI International, Washington DC.
- Xue, Y., Smith, J., Freund, D.A., & Aiken, L.H. (2012) Supplemental nurses are just as educated, slightly less experienced, and more diverse compared to permanent nurses, *Health Affairs*, 31, no.11, 2510-2517.
- Zhang, N.J., Gammonley, D., Paek, S.C., & Frahm, K. (2008) Facility Service Environments, Staffing, and Psychosocial Care in Nursing Homes, *Health Care Financing Review*, 30(2), 5-17.

Table 1: Descriptive statistics

Variable	n	missingness	mean	s.d.	min	max
Quality rating	1675	33.43	0.67	0.47	0	1
Care home level - staff						
Total staff	2516	0.00	46.92	29.34	1	339
Vacancy rate	1481	41.14	2.47	5.04	0.00	34.55
Turnover rate	1797	28.58	25.90	21.02	0.00	78.79
Retention rate	1540	38.79	75.51	20.03	13.51	100.00
Care staff temp/agency/pool %	2456	2.38	5.31	9.32	0.00	48.28
Nursing staff % (NH only)	757	11.05	14.08	5.60	1.02	34.48
Care home level - other						
Nursing	2516	0.00	0.34	0.47	0	1
Voluntary	2516	0.00	0.15	0.35	0	1
Beds	2516	0.00	40.25	22.76	1.00	236.00
Postcode level						
Competition (HHI)	2510	0.24	0.06	0.08	0.01	1.00
Female JSA %	2516	0.00	0.94	0.67	0.00	4.74
Female no quals %	2516	0.00	25.87	6.37	5.58	46.80
Pension Credit %	2516	0.00	17.77	8.39	0.64	66.25
DLA %	2516	0.00	4.67	1.90	0.17	12.73
Health bad %	2516	0.00	5.73	1.70	2.16	12.35
Activity limited a lot %	2516	0.00	8.31	2.28	2.92	17.70
Average house price	2516	0.00	259293	183995	54997	4819745
Population 65+	2516	0.00	6000	2878	242	16847
Instruments						
Vacancy rate – Apr 2015	1543	38.67	2.94	6.05	0.00	38.46
Turnover rate – Apr 2015	1712	31.96	23.67	18.24	0.00	66.66
Retention rate – Apr 2015	1488	40.86	76.34	19.39	14.29	100.00
Temp agency pool % - Apr 2015	2475	1.63	6.24	11.78	0.00	47.37
Nursing staff % (NH only) – Apr 2015	809	4.94	14.48	5.30	1.75	25.93
Female JSA % - LA	2516	0.00	0.97	0.49	0.27	3.01
Pension Credit % - LA	2516	0.00	17.27	6.31	5.74	52.00
DLA % - LA	2516	0.00	4.63	1.35	1.69	10.29

Table 2: Results

	Probit		IV probit		IV probit – NHs only	
	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.
Care home - staffing characteristics						
Vacancy rate	-0.020***	0.008	-0.044***	0.015	-0.058***	0.019
Turnover rate	0.004	0.004	0.005	0.004	0.002	0.006
Retention rate	0.009***	0.003	0.009***	0.003	0.007	0.005
Pool Agency Temp ratio	0.001	0.004	0.002	0.004	0.003	0.005
Nursing ratio					-0.007	0.015
Total staff	0.002	0.003	0.001	0.003	0.002	0.004
Total staff squared	2.6e-6	1.2e-5	5.1e-6	1.2e-5	5.3e-6	1.4e-5
Care home level - other						
Total beds	-0.004	0.004	-0.003	0.004	-0.0002	0.006
Total beds squared	-6.7e-6	2.7e-5	-1.1e-5	2.7e-5	-4.5e-5	4.4e-5
Nursing home	-0.248***	0.076	-0.208**	0.079		
Voluntary	0.346***	0.109	0.359***	0.110	0.475**	0.222
Postcode district level						
Competition (HHI)	0.166***	0.047	0.164***	0.047	0.283***	0.075
Female JSA %	0.145	0.100	0.140	0.099	0.102	0.175
Female no quals %	-0.008	0.014	-0.007	0.014	0.003	0.023
Pension credit %	-0.009	0.010	-0.008	0.010	-0.005	0.015
DLA %	-0.048	0.053	-0.051	0.053	-0.147	0.093
Health bad %	0.007	0.119	0.009	0.121	0.122	0.184
Activity limited a lot %	0.034	0.085	0.030	0.086	-0.032	0.128
Avg. house price (log)	-0.146	0.149	-0.120	0.150	-0.084	0.268
Population 65+ (log)	0.030	0.081	0.029	0.081	0.077	0.125
Regions		YES		YES		YES
Constant	2.295	2.156	2.004	2.172	1.443	3.901
n		2516		2516		851
Imputations		20		20		20
Average RVI		0.456		0.7252		0.380
Largest FMI		0.595		0.7832		0.618
			Statistic	Prob.	Statistic	Prob.
Weak instruments (vacancy rate)			35.82***	<0.001	35.82***	<0.001
Weak instruments (nursing ratio)					201.97***	<0.001
Over-ID (vacancy rate)			0.02 ^{NS}	0.981	0.02 ^{NS}	0.981
Over-ID (nursing ratio)					0.11 ^{NS}	0.893
Endogeneity (vacancy rate)			1.72*	0.091	1.72*	0.091
Endogeneity (nursing ratio)					2.63**	0.010

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. ^{NS} indicates not significant.

Regions: North East, North West, Yorkshire & Humberside, East Midlands, West Midlands, East England, London (omitted), South East and South West. Standard errors are clustered at postcode district-level.

Table 3: Marginal effects

Staffing measure	Probit		IV probit		IV probit (NHs only)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Vacancy rate	-0.0073***	0.0027	-0.0158***	0.0053	-0.022***	0.0073
Turnover rate	0.0014	0.0013	0.0017	0.0013	0.0007	
Retention rate	0.0032***	0.0012	0.0032***	0.0012	0.0028	0.0019
Pool Agency Temp ratio	0.0004	0.0013	0.0008	0.0013	0.0012	0.0019
Registered nurse ratio					-0.0028	0.0057

Appendix

Table A1: First stage regression models (IV probit) for each potential endogenous variable

	Competition		Vacancy rate		Turnover rate		Retention rate		Pool Agcy. Temp Ratio		Nursing ratio	
	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.
Care home staffing characteristics												
Vacancy rate			-0.046***	0.015								
Turnover rate					-0.007	0.006						
Retention rate							0.009	0.006				
Pool Agency Temp ratio									-0.0005	0.005		
Nursing ratio											-0.006	0.014
Total staff	0.003	0.003	0.001	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004
Total staff sq.	-5.1e ⁻⁷	1.2e ⁻⁵	4.7e ⁻⁶	1.2e ⁻⁵	-5.3e ⁻⁶	1.2e ⁻⁵	1.0e ⁻⁶	1.2e ⁻⁵	-5.0e ⁻⁷	1.2e ⁻⁵	1.2e ⁻⁶	1.4e ⁻⁵
Care home level – other												
Total beds	-0.005	0.004	-0.003	0.004	-0.004	0.004	-0.004	0.004	-0.005	0.004	0.001	0.006
Total beds sq.	-6.0e ⁻⁶	2.7e ⁻⁵	-1.4e ⁻⁵	2.7e ⁻⁵	-6.1e ⁻⁶	2.7e ⁻⁵	-3.6e ⁻⁶	2.7e ⁻⁵	-6.5e ⁻⁶	2.6e ⁻⁵	-5.1e ⁻⁵	4.3e ⁻⁵
Nursing	-0.299***	0.074	-0.218***	0.078	-0.270***	0.078	-0.265***	0.079	-0.298***	0.074		
Voluntary	0.340***	0.109	0.376***	0.112	0.298**	0.114	0.318***	0.110	0.342***	0.113	0.566***	0.210
Postcode district level												
Pred. comp (HHI)	0.208	0.163	0.239	0.165	0.205	0.165	0.209	0.166	0.202	0.162	0.429	0.268
Female JSA %	0.169	0.116	0.173	0.113	0.173	0.114	0.166	0.115	0.166	0.113	0.195	0.179
Female no quals %	-0.013	0.016	-0.013	0.016	-0.011	0.015	-0.010	0.015	-0.013	0.016	-0.015	0.026
Pension credit %	-0.008	0.010	-0.006	0.010	-0.008	0.010	-0.008	0.011	-0.008	0.010	0.007	0.016
DLA %	-0.053	0.062	-0.067	0.063	-0.059	0.062	-0.058	0.063	-0.052	0.062	-0.174	0.108
Health bad %	0.042	0.146	0.059	0.151	-0.010	0.150	0.014	0.150	0.038	0.146	0.238	0.234
Activity ltd. a lot %	0.027	0.086	0.018	0.088	0.044	0.089	0.039	0.088	0.029	0.086	-0.050	0.128
Avg. house price (log)	-0.157	0.148	0.103	0.149	-0.162	0.148	-0.159	0.148	-0.158	0.148	-0.093	0.271
Population 65+ (log)	0.049	0.104	0.061	0.105	0.051	0.105	0.051	0.107	0.048	0.105	0.170	0.172
n		2516		2516		2516		2516		2516		851
Imputations		20		20		20		20		20		20
Average RVI		0.177		0.652		0.486		0.481		0.216		0.320
Largest FMI		0.371		0.792		0.659		0.575		0.467		0.445
	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.
Weak instruments	54.78***	<0.001	35.82***	<0.001	79.52***	<0.001	55.47***	<0.001	347.86***	<0.001	201.97***	<0.001
Over-ID	0.24 ^{NS}	0.787	0.02 ^{NS}	0.981	0.00 ^{NS}	1.000	0.00 ^{NS}	1.000	0.00 ^{NS}	0.997	0.11 ^{NS}	0.893
Endogeneity	-0.26 ^{NS}	0.795	1.72*	0.091	0.63 ^{NS}	0.530	-0.48 ^{NS}	0.633	0.10 ^{NS}	0.919	2.63**	0.010

Notes: All models include regions and a constant (not presented). Predicted competition (i.e. instrumented) is used in all models as a dependent variable See notes for table 2.