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Cheap and Dirty: The effect of contracting out cleaning on cost and quality in English hospitals

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Abstract

Contracting out of public services, especially ancillary services, has been a key feature of New Public Management since the 1980's and by 2014, over £100 billion of UK public services were contracted out annually to the private sector. A number of high-profile cases has prompted a debate about the value-for-money these contracts provide. Value-for-money comprises both the cost (efficiency) and quality (effectiveness) of the services. We empirically test the effect of contracting out in the context of cleaning services in the English NHS. Additionally, we present and test a new theory of coupling: the effect of contracting of ancillary services on the quality of core services using the hospital acquired infection rate as our measure. We find that private providers are cheaper and dirtier than their in-house counterparts using data from 2010/11-2013/14 for 130 English NHS trusts.

Keywords: New Public Management; contracting out; hospitals; cleaning; NHS; hospital-acquired infections; contestability; quality shading; coupling

Cheap and Dirty: The effect of contracting out cleaning on cost and quality in the English hospitals.

Since the 1980's, New Public Management (NPM) has been the dominant paradigm within public service management in the UK, as well as in numerous other countries. A key feature of NPM was the introduction of competitive forces with the aim of lowering costs and improving service quality. By 2014, the UK government contracted out approximately £100 billion of public services annually (HCCPA, 2014). Yet there have been increasing concerns over whether these contracts offer value for money for the taxpayer, and/or deliver high quality services to users. A number of recent high profile contract failures, including G4S' poor performance in supplying security guards for the London 2020 Olympics, Serco's misreporting of GP out-of-hours services, and the overcharging for electronic offender tags by Serco and G4S, have raised further questions about the principle of contracting out public services. However, there is little robust evidence to inform the debate, something this paper seeks to redress. Further, whilst most of the public and political criticism of contracting out has focused on lower quality, so called quality shading, when core public services are contracted out to the private sector, we present and test a new theory that contracting out of ancillary services may also lower the quality of the core service even when the core service remains under public provision.

Contracting out refers to the provision of a public service by a private service provider that had previously been supplied by an in-house team. There are strong theoretical reasons to support contracting out. Driven by competitive forces and profit maximizing behaviour, private sector firms drive down costs because their shareholders are the residual claimants on any profit. By focusing on the provision of core services, public institutions can enhance service delivery and service quality whilst outsourcing other activities (Barney, 1991; Domberger et. al., 1995; Quinn, 1992). At the same time, the "contestability" of the outsourced service – the possibility

of replacing a contractor with another supplier – creates a competitive environment which lowers cost and improves quality (Domberger and Jensen, 1997). However, the profit motive also means that contractors have an incentive to drive down their costs of service provision either through lowering effort (shirking) or lowering quality (quality shading) especially where these are hard to define ex-ante or monitor ex-post. These two competing effects have led to mixed results in contracting out in practice.

Cleaning was one of the first services to be contracted out in the National Health Service (NHS) in the 1980s. Cleaning is not glamorous nor considered a core part of healthcare provision. However, during the 1990s, there was an increased incidence of hospital acquired infections, such as Meticillin-Resistant Staphylococcus Aureus (MRSA). These had an impact on the quality of patient care and the costs of treatment in the acute sector. An international study has since established links between cleaning quality and hospital acquired infections (Murphy, 2002). Healthcare associated diseases are a major problem with an estimated 1.4 million infections globally at any one time (Pittet and Donaldson, 2006), and an estimated 300,000 cases in the English National Health Service (NHS) each year costing over £1 billion (National Audit Office, 2009). The Health Act 1999 adopted new policy targets to assess and monitor providers' performance in reducing healthcare associated infections (Department of Health, 2009). Cleaning therefore provides an interesting context in which to study contracting out because it is long-established, widespread across the public services, is *relatively* straightforward to specify, and can impact patient health and the cost of care.

Quality shading of cleaning services could adversely impact the quality of care resulting in higher rates of hospital-acquired infections, worsening health outcomes and increasing the total costs of care (Dancer, 1999; 2008; UNISON, 2009). Numerous policy initiatives that attempt to reduce waiting lists combined with increased service demand and therefore higher

occupancy rates have created intense pressure on ward capacity. Set against this, trusts need to find significant efficiency savings which may result in them being overly focused on the cost of cleaning provision over service quality, and with limited resources to ensure that contracts are fully specified and clearly monitored and enforced. Together these factors may create a perfect storm in which hospitals are faced with a rapid rise in hospital acquired infection rates.

This paper studies the effectiveness (quality) and efficiency (cost) of the contracting out of healthcare cleaning services across 130 English NHS acute trusts from (financial year) 2010/2011 to 2013/2014. First, the effectiveness of contracting out of healthcare cleaning is examined through two patient reported indicators for the (non-microbiological) perceived cleanliness of wards and bathrooms. These outcome measurements are superior to activity or process-based measures (e.g. cleaning frequency). In addition, we study the effect of contracted out cleaning on the quality of the core hospital service by using the MRSA rate, one of the most widely spread hospital-associated infections that is affected by the level of cleanliness. Second, we empirically evaluate the efficiency of contracting out through estimating the cost-saving of contracted out cleaning services compared to in-house cleaners. Whilst this paper adds to the limited empirical literature on the effectiveness and efficiency of contracting out, it is the first paper to test the impact of contracting out of ancillary services on core service quality, what we term the coupling theory.

Using panel analysis techniques that control for trust and time specific effects, we find that contracted out cleaning services are, *ceteris paribus*, cheaper than in-house cleaning. However, we also find that hospitals that have contracted out cleaning also have lower cleaning quality, and higher hospital acquired infection rates. We go beyond the quality shading theory and demonstrate that contracting out of an ancillary service also lowers the quality of the core

service. In summary, contracted out cleaning is “cheaper but dirtier”. Our paper proceeds as follows. Section two discusses the theoretical underpinning of contracting public services and the empirical studies that assess the effectiveness of this mode of service provision. Data and methodology are presented in section three while section four discusses the empirical results. Our discussion and conclusion are in the last section.

THEORETICAL AND EMPIRICAL LITERATURE

Theoretical Framework

Contracting out is favoured under NPM due to its ability to draw detailed service specifications and designate set of goals, deliverables and performance management indicators to improve quality standards and accountability (Davies, 2001; Dwyer et al., 2014). The primary theoretical gain from contracting out, arises from the contestability of the market. That is the threat, or possibility, of replacing a contractor with another supplier creating a competitive environment in which firms must lower cost and improve quality to win and maintain the outsourced contracts. Boardman and Hewitt (2004) demonstrate that the degree of contestability depends on the level of (ex-ante and ex-post) competition and asset specificity, whilst Hart (2003) contends that the level of physical capital requirements is critical. Cleaning services have low levels of asset specificity as well as low physical capital requirements, making it a highly contestable market. Moreover, these factors ensure low entry and exit barriers to the cleaning sector resulting in significant ex-ante and ex-post competition due to a large number of suppliers. As a result, there should, in theory, be strong efficiency savings to be made through contracting out cleaning, and there is some evidence to support the claim that contracting out lowers cost (e.g. Domberger et. al., 1995; Megginson and Netter, 2001).

However, the transactions cost literature explains why the benefits of contracting out may not be fully realised. A complete contract is one that specifies the legal consequences of every possible state of the world. In reality, economic agents suffer from asymmetric information with the principal having less information, which means that contracts are inevitably incomplete or ill-defined (Grout, 1984, Hart and Moore, 1988; Williamson, 2000) and cannot be reliably enforced ex-post. This can lead to opportunism on the part of the contractor including shirking (lower effort) or quality shading (lower quality), especially where quality is hard to define ex-ante or observe ex-post. Moreover, a tension arises because the contractor derives all of the benefit of investing in cost reducing innovations but none of the benefits of quality improving innovations (Hart, 2003). This generates strong incentives to increase profits by lowering costs through reducing unobservable quality. Higher transaction costs are further incurred in monitoring the performance of contracted services, increasing the sophistication and details of service specifications and deliverables, and establishing dispute resolution mechanisms (Young and Macinati, 2012).

There are strong a-priori reasons to believe that cleaning contracts, and many other public service contracts, are miss-specified. Faced with the problem of monitoring and enforcing contract terms ex-post, principals use quicker and cheaper to observe metrics such as activity or process indicators rather than outcome indicators. For example, how often a ward is cleaned or response times to requests for ad-hoc cleaning. Contractors then face clear incentives to meet these targets or measures at the expense of good outcomes. Dickinson & Glasby (2010) argue that the extant literature on contracting out of public services has not given enough attention to performance outcomes but instead has rather focused on process outcomes. This can have catastrophic consequences when the contracted service is a major public service (e.g. a prison), but it can also have significant implications where the ancillary service may also affect the core

service provision. This is the case in cleaning. Hospitals are not cleaned to make it a more pleasant environment for patients, visitors and staff but to minimise the risk of hospital-acquired infection.

Contracting out has been particularly popular for ancillary or non-core public services. A core service is the primary activity the service provider specialises in and is able to allocate resources to generate value, while auxiliary services complement the primary services but do not depend on the core services. Examples of core and auxiliary services include healthcare and hospital cleaning, or education and school meals. Coupling is defined as the degree to which the quality of a secondary service affects the quality outcome of the main activity. Katzan (2008) argue that coupling is low in the case of auxiliary service. Atkinson (1984) argued that cleaning services in the healthcare is a secondary service and not necessarily connected to the core function of healthcare unit. Accordingly, it can be safely outsourced. However, there is no empirical evidence to support this claim.

Davies' (2010) first hypothesis a relationship between contracting out of cleaning services and healthcare associated infections, which remains untested. Although not empirically examined, the latter study argued that there is potential relationship between outsourcing cleaning services and healthcare outcome. Policymakers now have this strong belief that contracting out of cleaning services in the healthcare is mainly driven by cost reduction needs rather than any quests for improvement in quality. It is argued by Davies (2010) that the notion of cleaning in the healthcare as peripheral activity and an unskilled job (Messing, 1998) was the primary motive of outsourcing cleaning services and separation of cleaners from the rest of the ward team including clinical teams.

There are two streams of literature that relate to contracting out of hospital cleaning services. The first stream is the medical studies that examined the linkage of cleanliness with the

infection rate, for example Dancer (1999) and (2008), based on clinical evidence. Pratt et al. (2007) discuss the medical evidence, based on hospital reports and infection outbreak investigation, that suggest the robust association between hospital level of cleanliness and hospital associated diseases like MRSA. In addition, the latter study explicitly indicated that contracting out of hospital cleaning services has triggered an obvious decline in quality standards. The other plethora of studies focused on various theoretical reasons – for example the transaction theory- of failure of contracting out in the public services to meet quality standards.

For example, the auction theory argue that in case of asymmetric common value, when tenders are arranged as sealed bids or when the tender goes to the lowest bid, the price a firm offers depends not only on the costs faced by the firm but also on their competitors' unknown prices. This might result in less informed contractor known as winner's curse who attains zero profits and would result insignificant quality deterioration (Laffont, 1997).

Our paper builds on these two lines of literature to empirically investigate the effect of contracting out cleaning service on one of the top listed health outcome; infection control. From this discussion, we can formulate our third hypothesis based upon the degree to which the quality of the secondary or non-core activity affects the quality of the core activity; in our example the quality of cleaning and the quality of health as measured by hospital-acquired infections. We name this the degree of coupling. Highly coupled services like hospital cleaning and health care would mean that low quality cleaning would severely damage health care. Lowly couple services such as school cleaning and education would not exhibit such a relationship. Lowly couple services could be easily outsourced whilst highly coupled services would need to be outsourced with extreme caution.

A recent review by Torchia et al. (2015) shows that despite the fact that contracting out is now the dominant mode of supply for many ancillary services in the health care sector, there is little evidence of any realised improvement in either efficiency or effectiveness of these services. This is supported by an emerging literature that demonstrates that the cost reduction effects of contracting out are not sustainable in the long run (Hefetz and Warner, 2004; Van Slyke, 2003; Young and Macinati, 2012). Rampling et al. (2001) argue that the cost reduction policies that resort to contracting out of cleaning services are not cost effective and not sustained in the long-run.

Empirical Evidence

The empirical literature on the effect of contracting out on service price and quality is inconclusive and offers little insight into cleaning services. Domberger et al. (1995) find evidence that the contestability of the market is more important than the ownership (private v. in-house) of the eventual service provider for delivering cost reductions. The study found that contracting out in 61 cleaning contracts significantly reduced the price, while the quality of the provided service was not adversely affected irrespective of ownership. Szymanski and Wilkins (1993) and Szymanski (1996) extended Domberger et al.'s (1995) refuse collection dataset and reported similar results of around 20 percent recent cost savings for private service providers. Yet, these efficiency effects were higher for private contractors than the in-house teams, with the latter just attaining short-term cost reduction. Gomez-Lobo and Szymanski (2001) show that cost reduction from contracting out is significantly affected by the ex-ante competition in refuse collection, therefore the higher the number of competitors who are tendering the lower the cost of service. Milne at al. (2012) show that the larger the number of bidders the lower the subsequent quality of the contracted out services, including in ground maintenance, building cleaning, vehicle maintenance, street and other cleaning and refuse collection in 1,363 contracts in the UK.

The most recent literature is ambiguous. Domberger et al. (2000) use a two-equation recursive model to examine the effect of contracting out in 48 IT contracts, finding that contracting out has not resulted in significant cost savings but has improved the quality of services. Duggan (2004) shows that contracting out in the health care sector in California's Medicaid program resulted in a 17 percent increase in the total spending and deterioration in efficiency. There is also evidence that contracting out reduces service quality. Bedard and Frech III (2009) construct a three-year panel of US state prisons to investigate the effect of contracting out of medical services on the mortality rate of prison inmates. They find a significant relationship between greater levels of contracted out medical personnel and the mortality rate.

The empirical evidence is ambiguous but generally indicates that contracting out lowers both cost and quality. We add to the literature by being the first paper to empirically evaluate the effects of contracting on service-user measures of cleanliness which reflects a more realistic measure of achieved standards and link the cost and quality of cleaning services to measures of overall health care service quality by investigating the effect on hospital acquired infection rates. This addresses the shortcomings of assessing the quality of cleaning based upon visual assessments and aesthetic evaluations by focusing on objective, microbiological indicators that reflect the impact of cleanliness on clinical outcomes. As our coupling theory is new, there is no empirical evidence that tests this theory.

Based on the former arguments and theoretical insights, our hypotheses could be articulated as:

Hypothesis 1: Contracting out of healthcare cleaning services will result in lower quality cleaning performance [Quality Shading Theory]

Hypothesis 2: Contracting out of healthcare cleaning services will result in lower cleaning costs [Contestability Theory]

Hypothesis 3: Contracting out of healthcare cleaning services will result in higher hospital-acquired infection rates (i.e. worse healthcare) [Coupling Theory]

The contribution of our paper is thus twofold. First, we develop and test a new theory of coupling – the effect of ancillary service quality on core service quality – in the context of contracting out. Second, we provide new empirical insights on both the contestability and quality shading theories of contracting out, in particular by considering outcome quality measures rather than process or activity measures. Besides developing the academic literature in this area, we provide practical insights to help public service managers and policymakers design better contract specifications and monitoring processes.

METHODOLOGY

A panel dataset of 130 English acute NHS trusts was assembled for the three year period financial year 2010/11 to 2013/14 from multiple administrative datasets, as described in table 1, to examine the effect of contracting out of cleaning services on service quality and cost. The analysis is on trust level. Due to the process of compilation of data from different sources, we have missing observations which decreases our sample to 110 trusts for cleanliness indicators and MRSA analysis, and 114 trusts for the cost and staff analysis. Also, we omit all observations with mixed mode of cleanliness. This means if hospitals under certain trust adopt different modes of supply for cleanliness where some hospitals adopt in-house mode of supply and others adopt contracted-out. All hospitals in NHS England are managed by acute trusts which provide accident and emergency and inpatient and outpatient medicine services.

[Table 1- here]

We have two separate analyses for the quality and cost assessment of contracting of total 130 trusts across three years. The first hypothesis of the quality shading theory and the third one of the coupling theory are tested through regressing contracting out variable and other hospital specific control variables on quality indicators which are the non-microbiological, comprised of cleanliness of wards and bathrooms, and microbiological indicators of MRSA rate. Our second hypothesis that contracting out cleaning results in lower cleaning costs and greater efficiency is examined through (i) total expenditure on cleaning services in millions of pounds, and (ii) the number cleaning staff used (Full Time Equivalent).

Data

Dependent Variables

Quality Variables

Indicators of both subjective non-microbiological and objective microbiological cleanliness were used as measures of ex-post cleaning quality. The National Inpatient Survey (NIS) provides patient assessments of ward and bathroom cleanliness using a four point Likert scale - very clean, fairly clean, not very clean or not at all clean. The standardised mean of ward and bathroom cleanliness that controls for age, gender and method of admission, were used as subjective non-microbiological quality measures.

Dancer (2008) argues that the visual assessment of hospital cleanliness is subjective, inaccurate and not reflective of the microbiological cleanliness that would ultimately impact upon care quality. They may also be influenced by activity e.g. how often a patient sees a ward or bathroom being clean. Microbiological quality indicators in contrast would measure the effectiveness of cleaning services in reducing health care associated diseases (Green et al., 2006; Griffith et al., 2007; Malik et al., 2003). MRSA is one of the most common hospital acquired infections that is associated with cleanliness (Dancer, 1999; 2008; UNISON, 2009).

The bacteria remain on surfaces (e.g. door handles, sinks, or floors) for a long period of time if they are not killed or removed by cleaning. The MRSA per bed rate was therefore chosen as the objective microbiological cleanliness measure.

Cost Variables

We examine our second hypothesis that contracting out cleaning results in lower cleaning costs and lower number of cleaning staff- hence more productive labour. We use data from Hospitals' Estates and Facilities Statistics from the NHS Information Centre which reports expenditure on cleaning in millions of UK pound and the number of cleaning workers.

Independent Variables

Contracting Out Variable

Hospital Estates and Facilities Survey (HEFS) reports whether the acute trust uses contracted out, in-house or a mixture of both for its cleaning service. We have 15 observations in 10 trusts (which experienced in one or more years) hospitals with mixed modes of supply which were excluded from the analysis. A dummy variable was created for "contracted out" cleaning.

Trust Level Control Variables

A number of control variables were also included that may affect the quality measures. Higher occupancy rates increase the risk of infection spreading due to the physical proximity of patients, and a greater number of interactions between people and surfaces. Higher levels of occupancy or usage may also require a greater intensity of cleaning to maintain cleaning standards. Day case and overnight occupancy rates are included separately. Patient age may increase the risk of infection because it is associated with a greater number of co-morbidities and greater medical complexity, leaving patients more vulnerable to infection. There may also be an association between age and patient perceptions of cleanliness. Age is included as the percentage of patients who are 75 years old and above.

Median waiting time in days is included as patients who had to wait longer for their treatment may feel aggrieved resulting in a "protest vote" when completing the NIS. Waiting times may also be correlated with determinants on care quality not associated with cleanliness. The median is used because the distribution is highly skewed. High emergency admission rates may indicate high patient turnover and high levels of patient complexity, which may require greater levels of cleaning to maintain quality. Median length of stay in days and the percentage episodes that are day cases –referred as day case episodes- may affect quality measures. Each inpatient has an equal opportunity to complete the NIS, and therefore there is a bias towards day patients. It is possible that perceptions of cleanliness, and certainly the risk of infection, are associated with increasing length of stay (Clabots et al., 1992). These factors may also correlate with the general quality of the trust's clinicians and management. All of these variables were extracted from Hospital Episode Statistics (HES).

The size of the cleaning task – measured by the occupied floor area in square metres and the number of theatres – will undoubtedly affect the cost and the number of staff required. Greater floor area may also make cleaning more complex, providing greater opportunities for shirking and quality shading. A dummy variable to control for Foundation Trusts that have more fiscal autonomy and higher levels of management quality was also included.[1]

In the cost and staff analysis, two additional control variables are included. The status of the trust in terms of the quality and newness of building would affect the cleaning cost and the number of cleaning workers. Here we introduce two indicators to control for the status of trust facilities; the capital investments dedicated for new buildings and the amount of investments directed to finalise unfinished building works that is called backlog maintenance investments.

Estimation Method

Even a short panel such as this allows for some control of unobserved heterogeneity at the trust level. For all quality indicators and MRSA rate, a Hausman (1978) test supports a random effects specification. This implies that the random effect analysis yields consistent and efficient estimators in these specifications. For the cost and staff equations, Hausman test shows that fixed effects is the preferable specification.[2]

In reporting our results we show the correct panel analysis specification either by including fixed effects to control for trust-specific effects or by the more efficient and consistent random effect.[3] We tested for the inclusion of time-specific effects and the F-statistic could not reject the hypothesis of the significance of the unobservable time related heterogeneity for the quality indicators of ward and bathroom cleanliness as well as MRSA rates at one and five percent significance levels respectively. For the cost and staff analysis, the F-statistic shows the insignificance of the time-specific effects. All regressions reported below include standard errors which are clustered by trust; this controls for heteroskedasticity and correlation of the error term within trust. The correlation matrix shows that all the independent variables have low correlation.

RESULTS AND DISCUSSION

In 2010/11, 39 percent of trusts were contracting out their cleaning services while 59 percent used in-house teams. The remaining 2 percent had mixed modes of supply. The contracting out rate increased to 41 percent in 2011/12 before falling to 37 percent in 2013/14. Table 1 presents the descriptive statistics pooled over the 3 years excluding the 2 percent of trusts using a mixed mode of supply. The inpatient reported assessments of ward and bathroom cleanliness has average standardized scores of 8.83 (SD = 0.34) and 8.48 (SD=0.42) respectively. Trusts with

in-house cleaning showed higher scores of cleanliness of wards and bathrooms. The average MRSA rate was 0.81 percent per bed per annum, but it was exceptionally variable (SD = 0.58). The mean value for MRSA rate for the contracted out trusts was 0.94 while for the in-house trusts was only 0.72. The average cleaning cost (or the value of contract in-case of contracting) is £3.84 million per annum but is highly variable (SD = £2.63m), which also reflected in the huge variation in the number of cleaning staff (Mean = 165; SD = 116). This variation is likely driven by the size of the job as proxied by the floor area and the number of theatres. For instance, the floor area ranged from 680 m^2 to 522,000 m^2 while the number of theatres ranges from 12 to 56. The contracted trusts have shown higher average cost of cleanliness and higher mean values of cleanliness staff. Most of the control variables were highly variable which is indicative of the different types of NHS trusts featuring in the dataset. For instance, the average day case rate is 33.64 percent with the highest day case operations for Moorfields Eye Hospital NHS Foundation Trust, and the lowest is Birmingham Women's NHS Foundation Trust which has only 7.5 percent of operations as day cases. This reflects the complexity and invasiveness of the typical procedures in these specialist providers.

Estimation Results

Tables 2 presents the empirical analysis for the quality indicators whilst table 3 presents the results of the cost and staff analysis. In table 2, columns (1) and (2) show the empirical findings of the efficiency effects of contracting out on the inpatient survey indicators of ward and bathroom cleanliness while column (3) shows the empirical findings for MRSA rate.

[Table 2- here]

The R-squared ranges from 21 to 29 percent. The results show the negative coefficient on the contracting out variable, yet this quality shading evidence is not statistically significant for the standardised bathroom cleanliness. The coefficient estimates show that contracting out hospitals exhibit lower ward cleanliness of an average of 0.068 points and higher rates of MRSA per bed of an average 0.177 percent per bed which would mean on average 20 percent more MRSA cases for contracted hospitals. Therefore, our analysis shows an evidence of the association of contracting of cleaning with lower quality performance and deteriorated healthcare outcome as visually assessed by patients and as examined by hospital associated infection. This supports our first hypothesis of quality shading of contracting as well as our third hypothesis of the coupling theory that emphasise the relevance of the quality of auxiliary services in healthcare that might affect the health outcome.

As for the control variables, the empirical findings for MRSA estimation show that higher overnight bed occupancy rate positively affects the incidence of MRSA and support our hypothesis regarding the positive association of overnight occupancy rate and infection rates. The empirical findings in all specifications support our previous hypothesis of the adverse effect of the emergency admission rates on the quality of cleanliness in wards and bathrooms and the infection rate. The results show significant negative effects of the emergency admission on cleaning performance. Also the results show that trusts with higher admission emergency rates exhibit higher rates of hospital acquired infections. The findings show that the trusts with higher average waiting times exhibit lower MRSA rates. This might imply that shorter waiting time is not necessarily reflecting higher quality care, rather, it might come on the expense of lower cleanliness standards and higher infection rate. Moreover the results show the relevance of controlling for foundation trusts which exhibit significantly higher cleaning standards and lower MRSA rates.

Focusing now on the efficiency analysis, table 3 reports the results of cleaning cost and staff analysis to evaluate the effect of contracting out on cost of cleanliness and number of workers. Models (1) and (2) demonstrate the findings of the fixed effects analysis that controls for trust specific effects with goodness of fit of 20 and 23 percent for the cost and staff analysis respectively. The findings corroborate the cost savings effect of the decision to contract out cleaning services. The results show that a contracted trust would exhibit efficiency effects of cost reduction of an average one million pound compared to the insourcing trust. These results are significant at one percent significance level. This is supports our second hypothesis of the efficiency effects of contracting out in the line with the contestability theory.

[Table 3- here]

For the number of workers in model (2), the coefficient estimate shows that contracting out cleaning service has fewer workers but this effect is statistically insignificant. As expected, a number of trust characteristics are important in determining the cost of the cleaning contract and the numbers of staff employed. A higher proportion of elderly patient, greater number of theatres and lower investments in new buildings results in significantly higher cleaning costs. Other trust operating factors like occupancy rate, day case episodes and the emergency admission rate are not significantly affecting the cleaning cost. For the number of cleaning staff, lower day case occupancy rate, higher proportion of elderly patient and greater number of theatres and floor area of the hospital would results in higher number of cleaning workers.

CONCLUSION

Given the extended period of fiscal austerity, the public sector faces continued pressure to control costs and reduce expenditure. Whilst the NHS budget has been ring-fenced, the NHS is still required to fill a funding gap of between £22-66 billion by 2020. At the same time, the health minister Jeremy Hunt has made it clear that standards must not fall despite the constrained budgets. In light of this, auxiliary services such as cleaning, will be some of the most obvious targets for cost savings. The effectiveness and efficiency of contracted out cleaning in the NHS is therefore an important and salient policy question, that also holds wider relevance to the rest of the public sector as other public services seek to contract out non-core services and reduce the public sector payroll.

Policy makers adopted contracting out as one of the main pillars of NPM that allegedly aimed at enhancing the efficiency of the governmental body and introducing competitiveness. Still great enthusiasm holds for the NPM, yet, little evidence is held to support its effectiveness in attaining its designated outcome of cost savings and quality improvement. More importantly, previous studies examining the efficiency gains of contracted public services could not assess the source of cost reduction; is it due to specialisation, division of labour and private sector's incentives to adopt new practices and management scheme that enhance the service delivery. Whilst there is strong evidence that contracting out of ancillary services lowers costs, there is also mixed evidence that the quality of the service is also lower, or shaded, especially where quality is difficult or expensive to observe ex-post. Our study attempted to evaluate the efficiency and effectiveness of contracting out of healthcare cleaning services. Moreover we tested a new theory of coupling; the extent to which the contracting out of a non-core service may affect the quality of the core service, namely health outcomes. Controlling hospital

associated disease is a priority for the NHS, and health care services worldwide, which has a major impact upon the health and recovery of patients.

Our paper finds evidence that contracting out of healthcare cleaning in the NHS from 2010/11 to 2013/14 was not associated with any quality improvement, after controlling for relevant healthcare provider characteristics. On the contrary, this mode of supply resulted in lower cleaning standards as evaluated by patients and higher hospital associated infection rate as indicated by MRSA which supports the quality shading hypothesis and the strong coupling effect. On the other hand, we find the outsourcing of healthcare cleaning seemingly result in significant cost reductions. Previous studies found that contracting out cleaning services reduced expenditure and this was supported by our findings (Bedard and Frech III, 2009; Milne et al., 2012).

Focusing on the policy implications of our research, our results corroborate the theory that contracting out results in significant cost savings. Cost containment continues to be important in the health care sector both in the UK and globally as health care expenditures continue to rise. Therefore, it would be financially beneficial to continue with contracting out cleaning (and other ancillary services) but to redesign contracts to include measurable outcome-oriented targets rather than process or activity-based measures. For example, our study suggests that contracts should include a pay for performance term that ties total contract compensation to maintaining or lowering key hospital infection rates (e.g. MRSA) or to patient measures of cleanliness. Tracing of infection rate and quality of cleanliness as patient-assessed should provide the basis for contract continuation or discounts in contract value or even re-tendering of the service in case of failure to attain the quality targets. To create some incentives to attain quality standards, policymakers might offer some different price arrangements; for example

paying contracts in instalments based on performance criteria. Also, contracts might create some policy incentives to encourage innovation and creativity that would enhance quality standards, this might include some re-negotiations for contract value. Policymakers might need to adopt different models of pricing that set a direct link with outcome measurements.

NOTES

1- Foundation trusts are different from other NHS trusts in terms of their independent legal status and governance. These trusts are not monitored for performance by health authorities yet they are managed by board of governors formed from patients, staff and members of other organisations who are involved in decision making and long-term planning.

2- Random effect estimation would be the correct specification with the smallest standard errors, if the trust specific effects were not correlated with the other explanatory variables. In the case of quality and MRSA estimations, the omitted trust specific effects are not correlated with the explanatory variables. Therefore, we can safely include the trust specific effects in the error component and the random effect analysis would yield consistent and efficient estimators in these specifications. For the cost and staff analysis, trust specific effects have to be controlled which implies that the time-invariant trust specific effects that affect the cost of cleanliness and number of cleaning staff are correlated with other explanatory variables and these trust specific effects cannot be part of the random error component.

3- For the standardised ward and bathroom cleanliness and MRSA, the Chi-squared statistic of Breusch-Pagan Lagrange multiplier test shows that random effect is the correct specification compared to the pooled analysis. The F statistic for the joint significance of the fixed effects in cost and staff analysis show the significance of controlling for the trust specific effects.

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TABLES

Table 1- Descriptive Statistics

Variable	Source	Contracted out	In-house	All
Standardised ward cleanliness (standardised mean score)	A	8.78 (.39)	8.86 (.30)	8.83 (.34)
Standardised bathroom cleanliness (standardised mean score)	A	8.41 (.47)	8.54 (.37)	8.48 (.42)
MRSA (% per bed)	B	.94 (.69)	.72 (.48)	.81 (.58)
Cleaning cost (1000,000£)	C	4.09 (2.80)	3.68 (2.51)	3.84 (2.63)
Cleaning staff (number of staff)	C	175 (115)	159 (117)	165 (116)
Independent Variables				
Overnight occupancy rate (% of occupied beds from total available beds)	D	85.93 (8.53)	84.96 (6.96)	85.36 (7.65)
Daycase occupancy rate (% of occupied beds from total available beds)	D	87.00 (12.84)	86.54 (12.91)	86.73 (12.87)
Patient age (% of patients born 1948 or before)	E	21.48 (7.26)	24.00 (7.70)	22.98 (7.62)
Area (1,000 metre square)	C	94.58 (64.24)	92.19 (75.87)	93.16 (71.30)
Length of stay (median number of days)	E	1.39 (.72)	1.42 (1.17)	1.41 (1.01)
Waiting time (median number of days)	E	34.43 (9.15)	4.46 (44.46)	38.00 (35.02)
Day case episodes (% of day case episodes of the total number of episodes)	E	32.60 (11.06)	34.33 (8.17)	33.64 (9.46)
Emergency rate (% of emergency admission of the total admission)	E	33.46 (11.33)	35.46 (9.33)	34.66 (1.21)
Admissions (number of admitted patients)	E	79874.55 (43772.38)	77991.69 (41032.43)	78746.82 (42105.6)
Number of theatres	D	18 (10)	17 (9)	18 (9)
New building investments (1000,000£)	C	3.23 (5.60)	3.84 (1.50)	3.60 (8.88)
Backlog Maintenance Investments (1000,000£)	C	1.68 (2.41)	2.03 (3.91)	1.89 (3.40)

Notes: (1) A- National Inpatient Survey (NIS) data were supplied by the Care Quality Commission, B- Public Health England supplied by GOV.UK, C- Hospitals' Estates and Facilities Statistics (HEFS) supplied by NHS Health and Social Care Information Centre, D- NHS England, and E- Hospital Episode Statistics (HES) datasets supplied by NHS Health and Social Care Information Centre (2) All values in this table are the mean values while the standard deviation (SD) is between brackets.

Table 2- Quality of Contracting Out Cleaning and Cleaning Staff in Acute Trusts

	1- St.Ward Cleanliness	2- St.Bathroom Cleanliness	3- MRSA
Contracted-out	-.068*	-.061	.177**
	(.041)	(.049)	(.086)
Overnight occupancy rate	-.001	-.001	.013***
	(.002)	(.003)	(.004)
Daycase occupancy rate	.001	-.001	-.002
	(.002)	(.002)	(.003)
Patient age	.001	.009	-.005
	(.005)	(.006)	(.005)
Area	.000	-.000	.000
	(.000)	(.000)	(.001)
Length of stay	.009	-.008	-.033
	(.019)	(.027)	(.030)
Waiting time	-.002	-.002	-.005**
	(.003)	(.003)	(.000)
Day case episodes	.001	.005	.002
	(.004)	(.004)	(.005)
Emergency rate	-.013***	-.015***	.013**
	(.004)	(.005)	(.001)
Foundation Trusts	.127**	.137*	-.174*
	(.056)	(.071)	(.091)
R-squared	.291	.235	.212
Treatment Effects	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes
No of Obs.	305	305	312
Number of Trusts	110	110	110
Wald Chi-Static (P-value)	.000	.000	.000

Notes: (1) Standard errors clustered by trust in parentheses. *,**,*** indicate ten, five and one percent significance level respectively. (2) We are excluding trusts with hospitals with different modes of cleaning. Those trusts having some hospitals with contracting out and some others with in-house cleaning services.

Table 3- Cost and Efficiency of Contracting Out Cleaning and Cleaning Staff in Acute Trusts

	1- Cleaning Cost	2-Cleaning Staff
Contracted-out	-1.030***	-12.122
	(.298)	(28.107)
Overnight occupancy rate	-.013	-.890
	(.013)	(.856)
Daycase occupancy rate	-.009	-1.185**
	(.011)	(.466)
Patient age	.252***	13.570***
	(.087)	(3.713)
Area	-.001	.190**
	(.002)	(.089)
Number of theatres	2.781**	186.632***
	(1.229)	(56.592)
Day case episodes	.015	-.322
	(.021)	(1.049)
Emergency rate	.015	-1.378
	(.033)	(1.351)
New building investments	-.011***	-.152
	(.003)	(.231)
Backlog Maintenance Investments	-.035	-1.228
	(.023)	(.949)
Foundation Trusts	…	…
R-squared	.208	.231
Treatment Effects	Yes	Yes
Time Effects	No	No
No of Obs.	314	307
Number of Trusts	114	114
F Statistic (P-value)	.000	.000

Notes: (1) Standard errors clustered by trust in parentheses. *, **, *** indicate ten, five and one percent significance level respectively. (2) We are excluding trusts with hospitals with different modes of cleaning. Those trusts having some hospitals with contracting out and some others with in-house cleaning services.

APPENDIX

A1. Endogenity

In the analysis of the effects of contracting out on the microbiological cleanliness estimation, a bidirectional relationship between MRSA and length of stay and occupancy rate might be anticipated. This means that hospitals with higher infection rate higher are those with higher length of stay and occupancy rate, this would result in violations of one of the estimation assumptions. This endogeneity, if it exists, would generate biased (coefficients might be underestimated) and inconsistent (standard errors are incorrect) estimators.

We adopt Two Stage Least Square Method (2SLS) which is a widely adopted method in the literature (for example Sicialiani et al., 2009) that uses instrumental variables that are highly correlated with the endogenous variables but with zero-correlation with the error term. We use the number of adult and paediatric critical beds and number of operating theatres as instrumental variables.[1] Hospitals that treat more complex patients with multiple co-morbidities will need more theatres and critical care beds, and they will have a longer lengths of stay and occupancy rates on average. We perform a Durbin-Wu-Hausman test to compare the results of the 2SLS with the OLS regression, and to test for the null hypothesis of insignificant bidirectional relationship of length of stay and occupancy rate indicators with MRSA (Durbin, 1954; Hausman, 1978; Wu, 1973). The results show that we cannot reject the null hypothesis and therefore, we can say that our estimators are unbiased and consistent.

1 - All instruments are valid ones and they meet the two conditions of strong correlation with the tested endogenous variables and zero correlation with the error term. The F-statistic of the excluded instruments in the first stage regression shows that the instruments are highly correlated with the length of stay and occupancy rate indicators. The Hansen J test that examine the zero correlation with the error term could reject the null hypothesis of no correlation between the instruments and the error term, suggesting that the instruments are valid. we argue that length of stay and occupancy rates are correlated with

A2. Selection Bias

A trust's decision to contract out its cleaning service may not be (statistically) random. If the outcome variables (e.g. level of cleanliness or MRSA rates) are correlated with factors that determine the decision to outsource the cleaning service, this would result in selection bias. Selection bias was confirmed using the fully interacted linear matching (FILM) (Blundell et al., 2005) in case of ward and bathroom cleanliness and MRSA, yet it is insignificant for the cost and staff analysis. This model creates an interaction term of contracting out with all explanatory variables. The value of the coefficient of the contracted out would be the coefficient of the contracting out plus the coefficient of every interacted term multiplied by the mean value of every control variable so we allow the effect of contracting out to vary based on trust characteristics. The F test shows that there is significant bias due to heterogeneous effects for the ward and bathroom cleanliness and MRSA.

To eliminate this problem we employed propensity score matching (Rosenbaum and Rubin, 1983). This technique described in Becker and Ichino (2002) proceeds in two stages. First, we estimate the probability that a trust contracts out its cleaning based upon a number of observable covariates. A set of group of trusts that have similar levels of these observable covariates are created. This stage removes the selection bias. In the second stage, we adopt stratification matching to estimate the difference of cleanliness indicators and MRSA rates between the contracted out and in house cleaning services given the calculated propensity score. Stratification method tests the significance of the difference in the outcome measurements between the two groups after matching the propensity score. The results in table 4 show that after controlling for the selection bias and with a similar propensity score for both in-house and contracting out cleaning services, the MRSA rate is significantly higher for trusts with contracted out cleaning services.

Table 4- Bootstrapped Treatment Effect of Contracting out using Stratification Method

Outcome Measurement	ATT	t statistic	Contracted	Non-Contracted
St.Ward Cleanliness	-.061	-1.352	135	189
	(.045)			
St.Bathroom Cleanliness	-.081	-1.565	135	189
	(.052)			
MRSA	.180**	2.228	135	189
	(.081)			

The coefficient estimate of ward cleanliness and bathroom cleanliness is negative for contracted out cleaning services but statistically insignificant. This supports our previous results that shows that trusts outsourcing cleaning services have significantly lower performance standards and quality outcomes even after controlling for the non-randomness of the decision of the trust to contract out their cleaning.