# Horizontal or Vertical: Which way to integrate?

## Approaches to community services integration and consequences for emergency hospital activity

*A case study based on the Transforming Community Services Policy*


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**In 2010, Primary Care Trusts faced a difficult choice. The Transforming Community Services policy required a complete break of commissioner and provider functions. But what should PCTs do with the community health services they delivered; vertically integrate with an acute trust, horizontally integrate with a mental health trust, or set up a stand-alone community trust or Community Interest Company? Eight years on, this report explores the impact this choice had on the level and growth in emergency hospital use in older people and considers the wider implications for the NHS as it develops new models of care and integrated care systems.**

# Contents

# 1 Introduction

The *Five Year Forward View* contends that new organisational relationships are required to enable NHS providers to develop models of care that are orientated around the needs of patients. Partnership rather than competition is now seen as providing the momentum needed to transform traditional patterns of delivery. Two new models of care are proposed, Multi-speciality Community Providers (MCP) and Primary and Acute Services (PACS), to enable better integration between primary and community services, and between acute and primary care services. Integrated Care Systems represent the next stage in the journey to encourage collaboration between providers and to better respond to the needs of local populations. The most effective way to facilitate collaborative behaviour remains uncertain, though.

One of the uncertainties being explored through these policies relates to the benefits of structural approaches to integration. Fragmentation that results from multiple organisations being responsible for different elements of a pathway are well recognised in research. Organisational boundaries are set through designated responsibilities, resource envelopes and internal cultures and can be hard to span in practice. One solution is to merge organisations, creating a single entity with authority to allocate resources, reconfigure services and incentivise staff members to deliver more co-ordinated and flexible services. Such thinking has underpinned numerous policies in the English NHS and elsewhere. For example, care trusts were single organisations responsible for the commissioning and / or provision of community health and social care services. When introduced in 2002 Care Trusts were to become the main vehicle for delivering care to older people.[1] Structural integration however, is an intensive and disruptive process and the benefits rarely materialise quickly.

Boards and senior managers making decisions about whether to structurally integrate services are not well supported by research on the subject. The relative merits of vertical (i.e. acute-primary) or horizontal (i.e. primary-community / mental health) integration are also not well established. This paper provides new insights regarding these options through an analysis of the impact of organisational changes brought about by the Transforming Community Services policy in 2011. The policy required Primary Care Trusts to divest themselves of provider services through a limited set of mechanisms. Whilst some chose to vertically integrate community services with an acute hospital provider, others chose to horizontally integrate with a mental health provider or to establish new organisations without structural integration. These options were hotly debated by Primary Care Trusts, regulators, trade unions and patient groups alike and plausible arguments were made for each approach. Those in favour of vertical integration argued that Payment by Results would incentivise acute trusts to deploy newly acquired community services to reduce the

[1] Miller, R., Dickinson, H. & Glasby, J. (2011) The care trust pilgrims. *Journal of Integrated Care*, 19(4): 14-21

duration of inpatient spells and eliminate delayed transfers of care. Advocates of horizontal integration highlighted the opportunities to reduce reliance on acute care by providing a holistic patient-centred and community-based service to older people whose needs are complex and multi-faceted. Those who wanted to establish new 'stand-alone' community trusts or organisations talked of protecting the professional standards of community nursing and warned of the dangers of these services being assimilated and asset-stripped by larger organisations seeking financial savings. Seven years have passed since this natural experiment was conducted - sufficient time for differences in performance to emerge.

The paper focuses on the impact of changes to district nursing services (the largest service subject to the Transforming Community Services policy) on emergency hospital use of older people, a key metric of interest for national government.

> *"While much of the value of integrated care is related to the possibility of improving patient experience and other aspects of care quality, the major initiatives have nearly always had an aim to reduce emergency admissions. "*
>
> Emergency hospital admissions in England: which may be avoidable and how?
> Health Foundation 2018

Whilst no single metric can adequately describe the functioning of a health and care system, the rate of emergency hospital admissions and bed-days provides insight into how well the main components of a system work together to manage patient care proactively.

The paper seeks to answer the following question: Does structural integration of district nursing services with acute or other community health services have an impact on levels of emergency hospital admissions of older people? [2]

The paper also encourages reflection on policies that lead to structural change. In 2010-11, emphatic and definitive claims were made about the benefits of Transforming Community Services. Substantial resources were used to develop plans and extensive assurance processes were put in place to check that these would deliver the changes required. But as far as we can tell, no attempt was made to test whether the promised benefits were realised.

[2] Subsets of emergency hospital admissions, such as ambulatory care sensitive admissions and readmissions are also a common focus of integration initiatives. We have not explored the impact on these metrics in this paper.

Eight years on and familiar claims are being made about the benefits of structurally integrating services. Management teams are exploring options and developing plans and regulators are establishing new assurance frameworks. The question of whether and how to structurally integrate services lies at the heart of this process. This paper attempts to draw out the lessons from Transforming Community Services for those wrestling with this question.

# 2 Transforming Community Services

The NHS in which Transforming Community Services (TCS) was introduced has many similarities to the NHS of 2018. The main providers of acute and mental health services were NHS Trusts or Foundation Trusts; general practice was the dominant service in primary care; and social care was delivered largely by independent sector organisations. Local Authorities were responsible for commissioning and care management of social care services. The Care Quality Commission was created in 2008 to amalgamate the separate care regulators in health and social care. Monitor was in existence but was responsible for the authorisation and regulation of NHS Foundation Trusts. Commissioning and oversight was achieved through different bodies. There were ten Strategic Health Authorities accountable for the implementation of national policy via regional strategies, performance management and financial health of the NHS services in their region. Commissioning was largely carried out by 152 Primary Care Trusts with specialist commissioning coordinated by Strategic Health Authorities. Primary Care Trusts also delivered the majority of community health services including district nursing. There were also ten Care Trusts which commissioned and /or delivered health and social care services. World Class Commissioning had set out the expectations of what good commissioning would look like through eleven core competences and an associated assurance framework. The Commissioning for Quality and Innovation scheme had been introduced as a lever through which commissioners could encourage providers to achieve best practice in their selected areas.

Policy interests were similarly familiar although with perhaps different emphases[3]. Concerns were being raised about the ageing population and related challenges such as multi-morbidities and increasing rates of dementia. Developing a more preventative approach with more activity within primary care was promoted as better for patients and more cost-effective. There were major concerns about health inequalities with the launch of the Marmot review in 2008. Patient choice over where care was received was seen as an important outcome and a driver of quality, with a connected expectation that commissioners would ensure that there was sufficient competition within their local system. The Principles and Rules of Co-operation and Competition for the NHS were introduced in 2008 to set out the expected behaviours of commissioners and providers in this regard with the launch of the Cooperation and Competition Panel in 2009 to investigate potential breaches. Social enterprises were being promoted as a means to develop value-based diversity alongside private sector involvement in elective and mental health care[4]. They were also seen as a potential means to encourage more mutual models within health care with engagement of staff

[3] For a concise overview of related health policy see Charles, A., Ham, C., Baird, B., Alderwick, H. and Bennett, L. (2018) *Reimagining Community Services. Making the most of our assets*. London: Kings Fund.
[4] Miller, R. Millar, R. & Hall, K. (2012) New development: spin-outs and social enterprise: the 'right to request' programme for health and social care services. *Public Money & Management*, 32(3): 233-236

receiving much interest in general. This was principally in connection with improving quality with Lord Darzi defining the three areas of safety, experience and effectiveness. Better integration was as ever an aspiration with the national Integrated Care Pilots exploring new approaches to vertical and horizontal integration.[5]

Transforming Community Services arose from a number of these policy areas[6]. These services were seen as a major component of moving care closer to home but there was little understanding of how the £10 billion funding was currently used and the outcomes that were delivered. There were also concerns that the variations in what was delivered were often a matter of history rather than local responsiveness, and that quality was often poor. Transforming Community Services was developed to strengthen the commissioning and delivery of community services. This was to ensure the quality of those services in their own right but also to help divert or prevent acute sector activity. In the words of two of its key architects - *"It's also about investing to save. There are areas investing heavily in community services already, in order to reduce inappropriate hospital utilisation, but we need to step that up*" (Joe Gannon) and "*We see these services as being key to radically increasing the efficiency of hospital services*" (Bob Ricketts)[7]. Transforming Community Services has several components (see Box 1) with the hope that collectively they would result in 'service transformation' led by clinical staff.

The structural component of Transforming Community Services related to the future delivery of the community services contained within Primary Care Trusts. This was seen as a dilution of the independence of commissioners as purchasers and whilst not usually articulated as such was undoubtedly seen by some in government as an opportunity to develop further the market place of community health service providers. *Enabling new patterns of provision*, the key policy document, emphasises that there was a need to develop community service organisations which were able to undertake the necessary transformation (i.e. that the existing ones were not) – "*they must be fit for purpose, empowering and enabling staff to provide safe, effective, personalised care"* (p15). Such transformation was seen as an enabler for more integrated care, and the transfer of care and treatment from hospital to the community in order to reduce hospital admissions and length of stay. The initial timeline was that Primary Care Trusts should introduce internal separation between their commissioning and provider arms by April 2009 with an accompanying 'contract' regarding what

[5] Europe, R. A. N. D. (2011). Ernst & Young LLP (2012): *National Evaluation of the Department of Health's Integrated Care Pilots*. Cambridge: RAND.
[6] DH (2009) *Transforming Community Services: Enabling new patterns of provision*. London: Department of Health.
[7] HSJ & DOH (2009) Ambition, Action & Achievement: How to deliver quality care closer to the patient. *Health Service Journal supplement 9 July 2009.*

would be delivered by their direct services. By October 2009 a detailed plan should have been in place for the future of their community services with implementation from April 2010.

*Box 1 Transforming Community Services*

Improving Services ● Transformational guides in six service areas ● Quality framework ● Productive Community Services programme

Developing People ● Six "transformational attributes" of the workforce ● Workforce and organisational development ● Innovation and leadership fund

Reforming systems ● Guidance on new patterns of provision ● World class commissioning toolkit ● Currency and pricing guidelines ● A national standard contract ● Community information models and datasets

The NHS Operating Framework of June 2010 (post-election of the coalition government) required that implementation should be achieved by April 2011[8]. Interim arrangements could be set up if the long-term home of these services could not be confirmed. There were six options that could be considered (see Box 2) with an emphasis on local decision making in consultation with patients, stakeholders and staff members within community services. That said, proposals had to signed off by the Strategic Health Authority through a formal assurance process. There are indications that in some regions these bodies put pressure on Primary Care Trusts to consider or reject one or more options suggesting that they did not always have the expected autonomy[9].

The NHS Confederation described the sector as welcoming a greater policy interest being shown in community health services '*after many years in the desert*'. They also supported the potential of the policy to improve integrated care as this "*offers opportunities to break free from the stranglehold of the division between primary and secondary care that has constrained innovative thinking in the past*".[10]

[8] DH (2010) *Transforming Community Services: The assurance and approvals process for PCT provided community services.* London: Department of Health.
[9] Hall, K., Miller, R. & Millar, R. (2012) Jumped or pushed: what motivates NHS staff to set up a social enterprise? *Social Enterprise Journal*, 8(1): 49-62
[10] NHS Confed Primary Care Trust Network (2010) *Transfer and transform: The challenges for community health services.* London: NHS Confed.

*Box 2 Transforming Community Service Options*

The most likely options:
> Integration with an NHS acute or mental health provider
> Integration with another community-based provider
> Social Enterprise.

Options, but not expected to be the norm:
> Community Foundation Trust
> Continued PCT direct provision
> Care Trust which includes provision

Extract from Transforming Community Services - The assurance and approvals process for PCT provided community services[11]

However, the NHS Confederation also raised concerns about the 2011 deadline, particularly with the potential interest from Monitor and the Co-operation and Competition Panel. Unions were concerned that the policy could lead to privatisation of NHS services with consequential impacts for staff terms and conditions as well (from their perspective) for the future sustainability and quality of services[12]. The transfer to social enterprise was seen by national union bodies as also opening up greater opportunity for privatisation although some local union branches were more open to the prospect if this option was supported by their members.

[11] DH (2010) *Transforming Community Services: The assurance and approvals process for PCT provided community services.* London: Department of Health.
[12] Joint Trade Unions (2010) *Transforming Community Services A trade union guide Supplement*. London: Unison.

# 3 Community Nursing Services for Older People

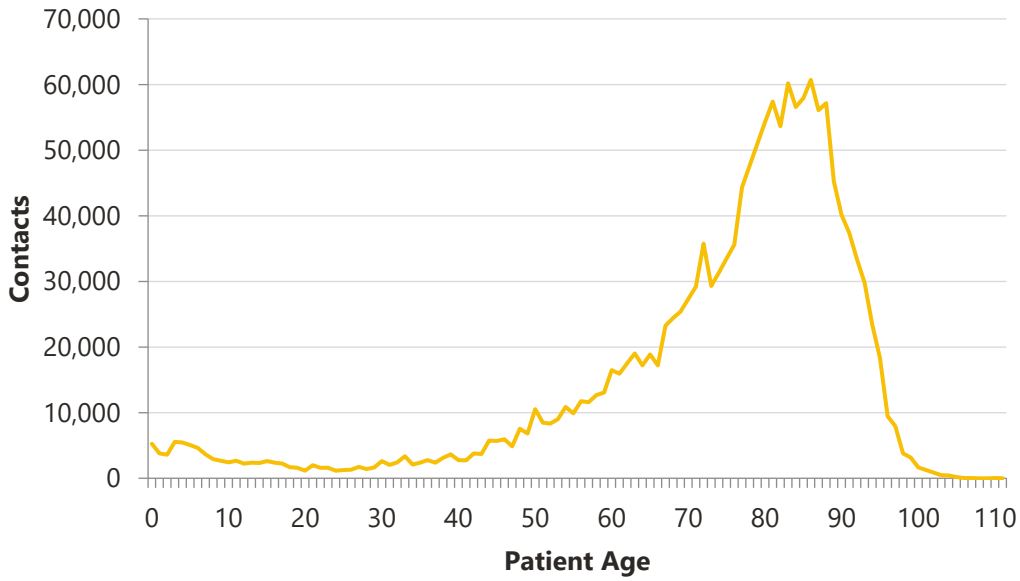
For the purposes of this paper, we use the term 'community nursing' to describe the nursing support that is delivered to patients in their own homes by district and specialist nurses. This care might entail health monitoring (checking temperature, blood pressure and breathing), wound care or setting up intravenous drips, but may also involve specialist care for people with for example diabetes or COPD or those approaching the end of their lives.

Data from NHS Digital indicates that the NHS in England employs approximately 30 thousand full-time-equivalent district and community nurses. These numbers are small however in comparison with hospital-based nurses (c. 175 thousand full-time-equivalent) and whilst hospital-based nurse numbers are increasing, community nursing numbers are on the decline.

The NHS plans to introduce a standard minimum dataset for community nursing, collecting information from each provider about the patients it supports and the services it delivers. Whilst the requirement to collect this information has not yet been mandated, some local providers have submitted draft returns to NHS Midlands and Lancashire Commissioning Support Unit. We use that data here to provide an overview of community nursing services in four local authorities (Birmingham, Dudley, Wolverhampton, Sandwell) where data coverage appears largely complete.

Figure 7 displays the age profile of patients receiving community nursing services. Whilst community nurses work with patients of all ages, those aged 75+ years are the most intensive users of the service and consume 60% of service activity.

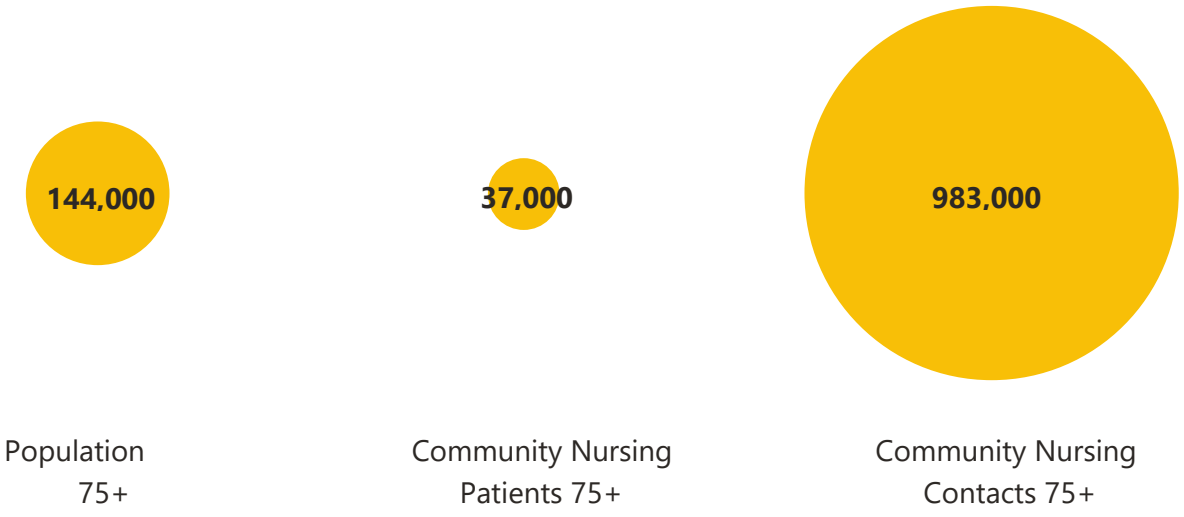
*Figure 3.1: Community Nursing Contacts by Patient Single Year of Age*[13]




[13] Birmingham, Sandwell, Dudley and Wolverhampton in 2015/16

In 2015-16, 1 in 4 people aged 75 and over in the 4 local authorities received one or more visit from community nursing services. On average this group received 27 visits each over the course of the year.

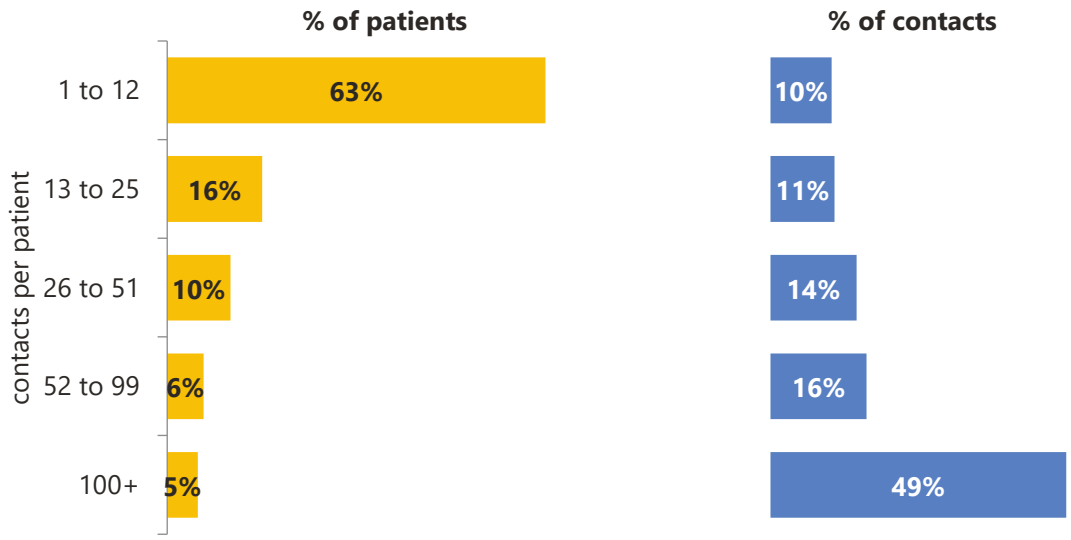
*Figure 3.2: Community Nursing Contacts, Patients and Population aged 75+*[14]




The intensity of the service delivered by community nursing varies considerably with 63% of patients receiving less than 13 contacts each per year, whilst 5% of patients receive almost half of all contacts delivered.

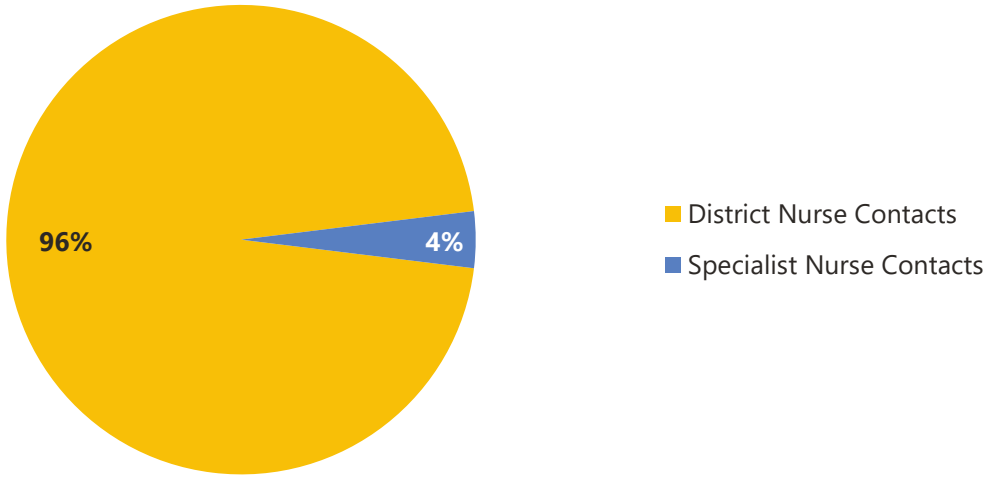
*Figure 3.3: Community Nursing Contacts per Year*[15]

[14] Birmingham, Sandwell, Dudley and Wolverhampton in 2015/16
[15] Birmingham, Sandwell, Dudley and Wolverhampton in 2015/16




The vast majority of community nursing contacts for people aged over 75 are delivered by district nurses, with specialist nurses delivering only 4% of contacts.

*Figure 3.4: District Nursing and Specialist Nursing Contact for Patients aged 75+*[16]



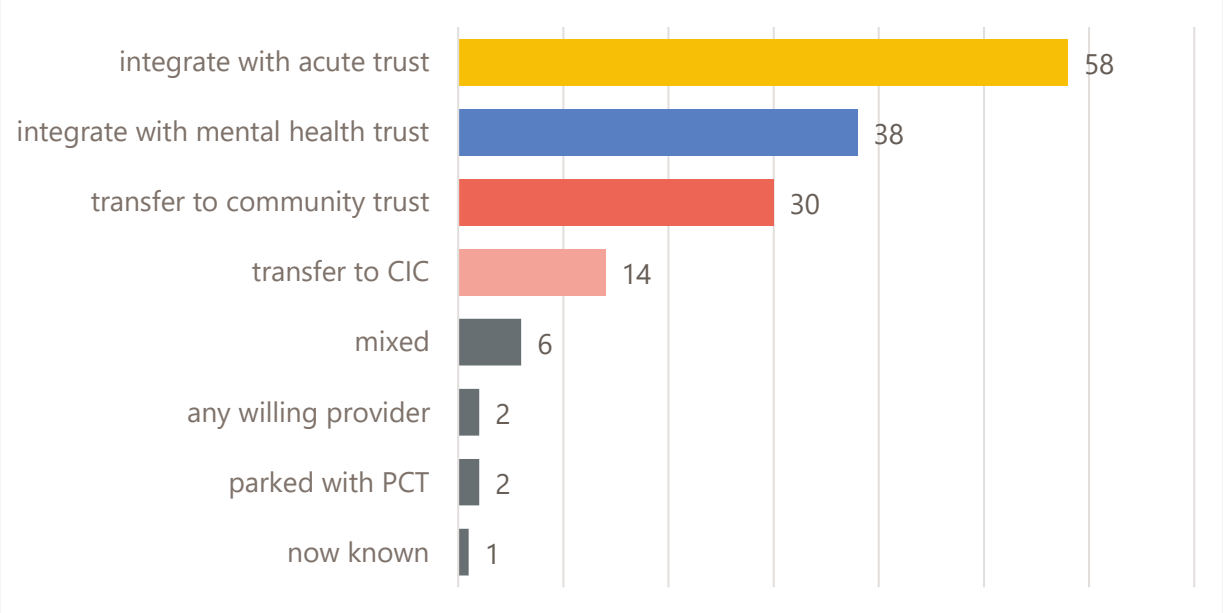

[16] Birmingham, Sandwell and Wolverhampton in 2015/16

# 4 Community Nursing – Organisational Changes in 2011

The Transforming Community Services policy triggered the transfer of a wide range of services and facilities from Primary Care Trusts to acute and mental health trusts and a set of new organisations. These transfers took place over an extended period, although most transfers occurred in the financial year starting April 2011. Karen Spilsbury (2013) described the transfers that took place for community nursing services, the largest category of service subject to the TCS policy.[17] 151 primary care trusts transferred community nursing services to 102 receiving organisations. Spilsbury (2013) categorised the transfers as follows;

- Transfer to a new NHS Community Trust
- Transfer to a new Social Enterprise / Community Interest Company
- Integration with an NHS Acute Trust (including FTs)
- Integration with a Mental Health Trust (including FTs)
- Procurement via Any Willing Provider contract
- Parked temporarily with a Primary Care Trust at 'arm's length'

*Figure 4.1: PCT transfers of community nursing service resulting from the TCS policy (n =151)*[18]




[17] Spilsbury K, Pender S, A changing landscape: mapping provider organisations for community nursing services in England, Journal of Nursing Management, 2013

Integration with acute hospital provider was the most common organisational model selected by Primary Care Trusts for their community nursing service (n = 58), followed by integration with a mental health provider (n = 38), transfer to a community trust (n = 30) or to a community interest company (n = 14). 6 Primary Care Trusts adopted a mix of organisational models, 2 selected a supplier using an 'any willing provider' (AWP) approach, 2 postponed the transfer of community nursing and the organisational model chosen by one Primary Care Trust was not known.

In this paper we focus our attention on the 140 Primary Care Trusts that transferred services to a community trust, a community interest company, or integrated services with an acute or mental health trust and classify these as follows.

| | |
|---|---|
| Integrate with acute trust | Vertical Integration |
| Integrate with mental health trust | Horizontal integration |
| Transfer to a community trust<br>Transfer to a community interest company | No structural integration |

The population aged 75+ was smaller and deprivation levels were higher on average for those PCTs that chose to integrate community nursing services with an acute trust.

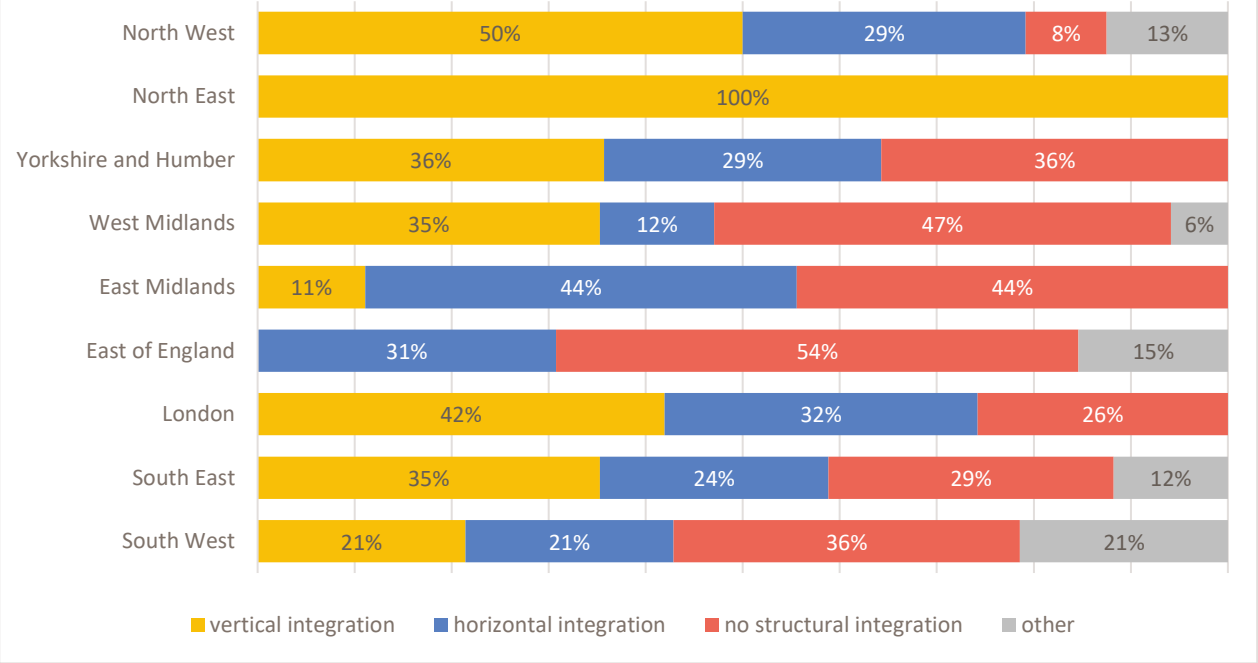
*Figure 4.2: Description of Primary Care Trusts by TCS Transfer (n= 151)*

| | | | Organisational Model Adopted in 2011/12 | | | |
|---|---|---|---|---|---|---|
| | | | vertical integration | horizontal integration | no structural integration | other |
| Primary Care Trusts | | Number [%] | 58 [38%] | 38 [25%] | 44 [29%] | 11 [7%] |
| Population aged 75+ ('000s ) | 2011 | Mean [SD] | 22.4 [14.7] | 29.4 [20.8] | 30.9 [22.0] | 32.7 [26.6] |
| % Population aged 85+ * | 2011 | Mean [SD] | 27.8% [1.9%] | 28.7% [1.8%] | 28.8% [2.1%] | 28.9% [3.4%] |
| Deprivation Score | 2010 | Mean [SD] | 25.7 [8.4] | 22.4 [7.8] | 22.8 [8.4] | 20.6 [8.9] |

* of those aged 75+

There was substantial variation in the approaches taken to community nursing service transfers between regions. All community nursing services in the North East were vertically integrated with acute trusts.  No such transfers took place in the East of England.

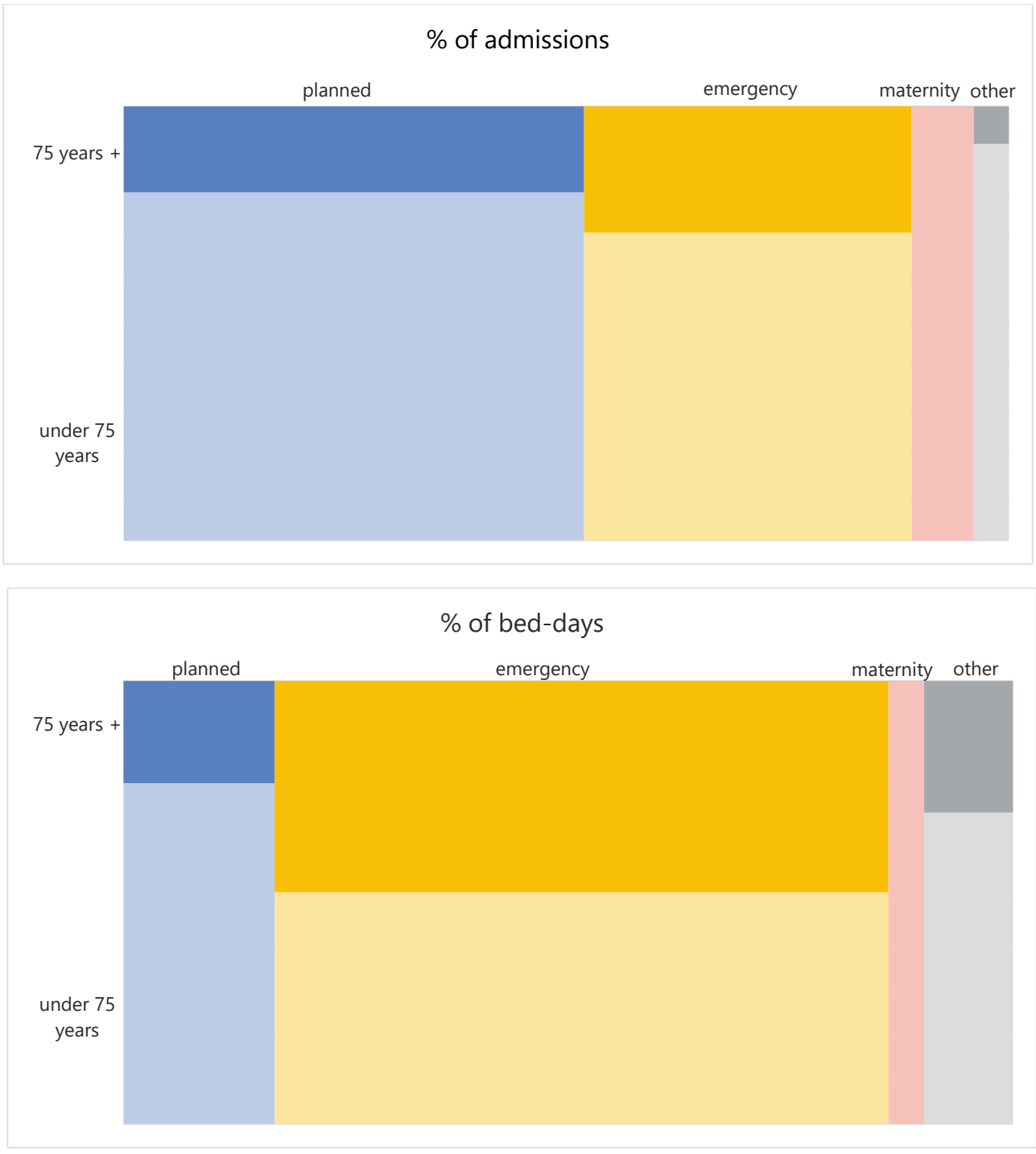
*Figure 4.3: Description of Primary Care Trusts by TCS Transfer and Region (n= 151)*



# 5 Emergency Hospital Use in Older People

Approximately 35% of all hospital admissions occur at short notice in response to a perceived clinical need. A substantial proportion of these emergency hospital admissions relate to patients aged 75 years and over.

*Figure 5.1: Hospital admissions and bed-days by admission method and age in 2015/16*

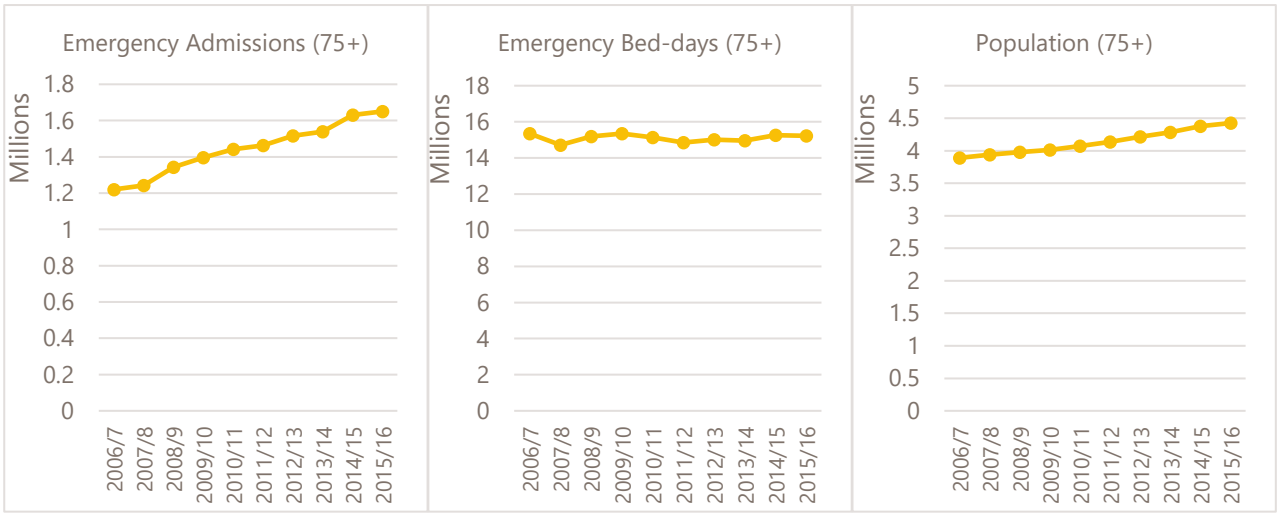



On average patients admitted on an emergency basis stay longer than those admitted on a planned basis, and older people stay longer than working age adults and children. As a result,

approximately 7 out of every 20 hospital beds in England are occupied by patients aged 75+ who were admitted in an emergency.

Emergency hospital admissions for patients aged 75+ increased from 1.22 million in 2006/7 to 1.65 million in 2015/16, faster than the rate of population growth. Over the same period, emergency bed day use for patients aged 75+ has changed little, suggesting average lengths of stay in hospital have reduced.

*Figure 5.2: Trends in emergency hospital admissions, bed-days and the population aged 75+*



# 6 Impact of Integration on Emergency Hospital Use

Many healthcare policies and interventions have sought to reduce hospital use in older people through the provision of more proactive and coherent community-based care. Community nursing represents one of the key services that are provided to older people to prevent hospital admissions where this is possible and to facilitate prompt discharge from hospital should an admission be necessary.

The Transforming Community Services initiative recognised the role that community nursing could play in reducing hospital use. When setting out plans to transfer community nursing services, PCTs were required to demonstrate how these plans would reduce emergency hospital admissions and lengths of stay. [19]

Prompted by the TCS policy, PCTs engaged in extensive debates in 2010 and 2011 about which organisational model represented the best solution for community nursing services. We might reasonably expect therefore that some systematic difference in emergency hospital use would have subsequently emerged between those PCTs that vertically or horizontally integrated community nursing services and those that established new host organisations. The Transforming Community Services initiative provides us with a rare opportunity to assess whether alternative approaches to integration have had a differential impact on a key outcome of interest: the rates of emergency hospital use in older people.

Rates of emergency hospital admissions and bed day use for older people were not static prior to the TCS policy. To explore whether the approaches to integration have differentially altered older people's emergency hospital use, we must take account of these prior trends.

Figure 9 includes estimates of emergency hospital admissions and bed day rates, for those PCTs that vertically integrated, horizontally integrated or did not structurally integrate community nursing services. Figures are provided at three points in time: in 2006/07 prior to TCS; at 2011/12 when the TCS changes were enacted; and in 2015/16. An initial visual inspection suggests that upward trends in emergency admission rates and downward trends in emergency bed-day use that were present prior to the TCS policy initiative, continued for all three groups. Emergency bed day use was notably lower for those PCTs that did not structurally integrate community nursing services, prior to and after the organisational changes driven by TCS.

[19] DH (2010) *Transforming Community Services: The assurance and approvals process for PCT provided community services.* London: Department of Health.

*Figure 6.1: Emergency Admission and Bed-day Rates 75+ by Organisational Model (n= 140)*

| | | Organisational Model Adopted in 2011/12 | | |
|---|---|---|---|---|
| | | vertical integration | horizontal integration | no structural integration |
| Primary Care Trusts | Number [%] | 58 [38%] | 38 [25%] | 44 [29%] |
| Emergency Admission Rate (75+) | 2005/06 | 0.33 | 0.32 | 0.31 |
| | 2011/12 | 0.37 | 0.35 | 0.35 |
| | 2015/16 | 0.38 | 0.37 | 0.37 |
| Emergency Bed-day Rate (75+) | 2005/06 | 4.22 | 4.02 | 3.70 |
| | 2011/12 | 3.88 | 3.55 | 3.42 |
| | 2015/16 | 3.66 | 3.46 | 3.30 |

Figure 10 illustrates the trends in emergency admission and bed-day rates for older people for PCTs adopting each of the 3 organisational models from 2006/7 to 2015/16. The charts demonstrate the wide variation in levels and trends in activity that exist within each of the three groups of PCTs.

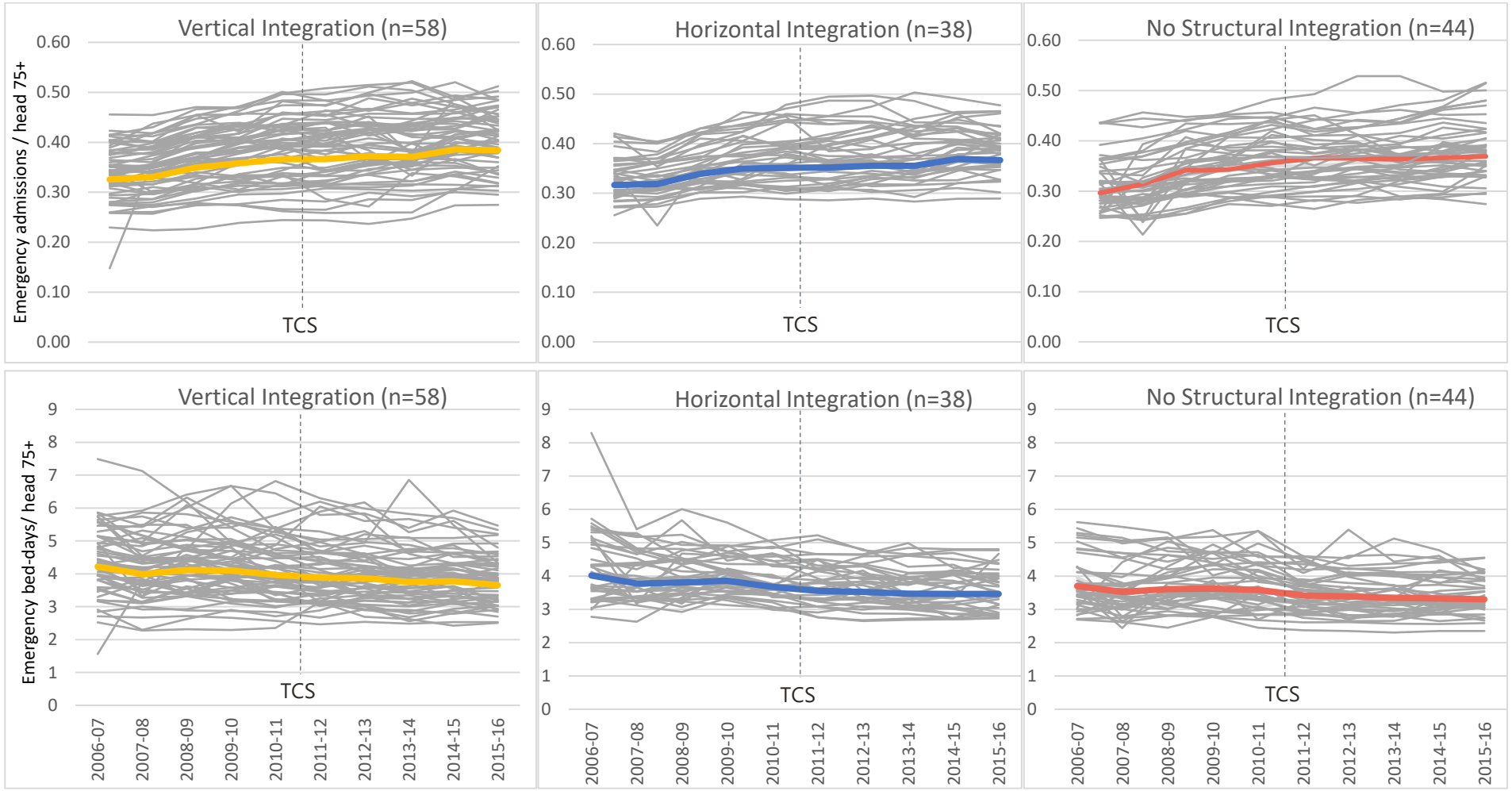
Whilst these figures do not indicate any large systematic and differential effect of organisation model on emergency hospital usage rates, there would be value in identifying even modest differences in performance between the models, should these exist.

We use this data and an established statistical method, negative binomial regression for panel data, to test whether on average, PCTs that chose to vertically integrate community nursing services experienced a change in the rate of emergency hospital admissions relative to those that horizontally integrated these services and those that established community trusts or CICs.

Decisions about whether and how to integrate community services were taken through an extensive deliberation process and it is important to acknowledge that differences in our outcome variables may arise as a result of differences in characteristics between the three groups of PCTs (horizontal integration, vertical integration and no structural integration).

*Figure 6.2: Trends in Emergency Admissions and Bed-days Rate per Head of Population 75+*

*(Grey lines represent individual PCTs, coloured lines represent the aggregate rate across the PCTs in each group)*

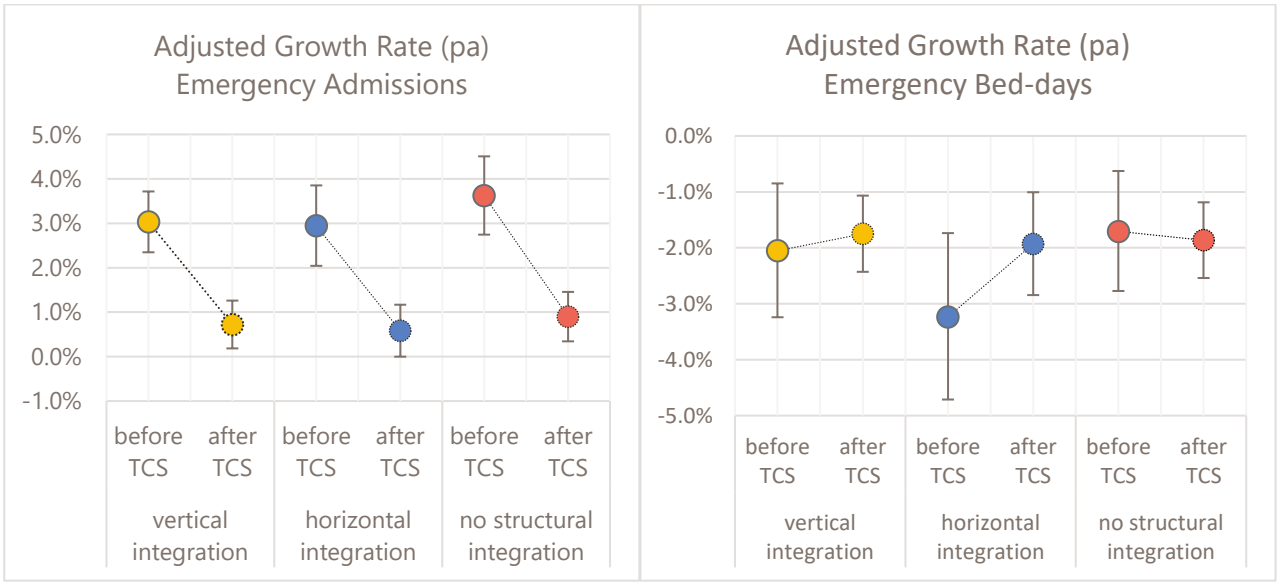


Our approach takes account of the rates of population growth and controls for the average level of deprivation in each PCT.[20,21] More generally panel data regression reduces the risk of omitted variable bias. Details of the data sources and methods used can be found in the technical appendix.

Having adjusted for changes in population size, structure and deprivation levels, growth rates in emergenecy hospital admissions (aged 75+) prior to TCS were 3.0% per annum for PCTs that went onto vertically inetegrate community nusring services, 2.9% for those that horizonatally integrated community nursing services and 3.6% for those that did not structurally integrate community nursing. In the years that followed TCS, the rates of growth in emergency hospital admissions fell in all three groups to 0.7%, 0.6% and 0.9% respectively. Whilst the change in growth rates seen in all three groups is statsitiscally significant ($p < 0.05$), the difference between the groups both before and after TCS are not.[22]

*Figure 6.3: Adjusted Growth Rates (per annum) in Emergency Hosptal Use (75+) Before and After Transforming Community Services*

*Whiskers (error bars) denote 95% confidence intervals*




[20] Population growth rates aged 75+ and 85+

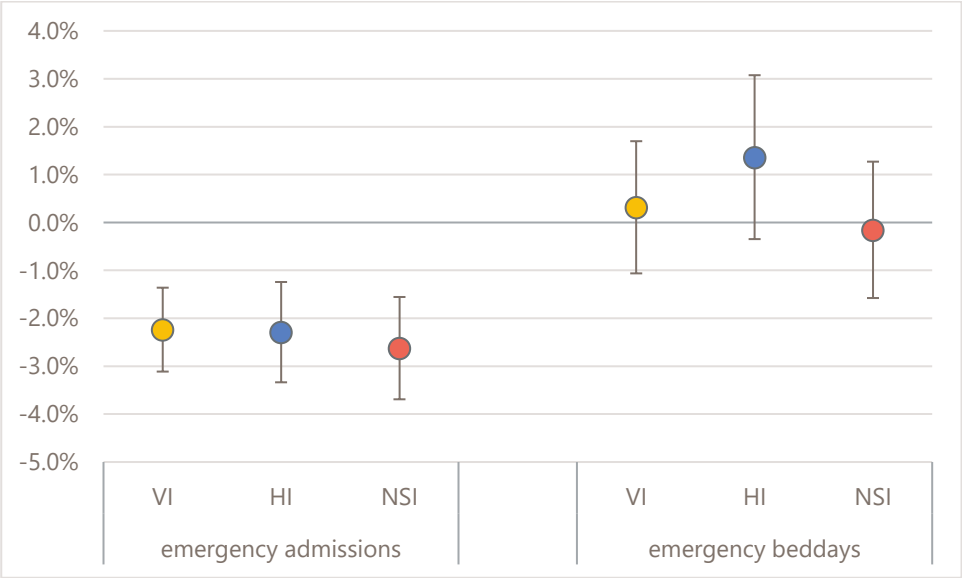
[21] Using the English Indices of Multiple Deprivation 2015, DCLG

[22] Note that this analysis is not designed to assess the impact of the TCS policy per se, but rather the differential impact of TCS integration options. In particular we cannot conclude from this analysis that the TCS policy caused the reduction in emergency admission rates.

For emergency bed day use (75+), growth rates were broadly similar (c -2.0%) before and after TCS in all three groups of PCTs. The changes before and after TCS and the differences between the 3 groups were not statistically significant (p > 0.05).

*Figure 6.4: Change in Adjusted Growth Rate (per annum)*

*Whiskers (error bars) denote 95% confidence intervals*




In conclusion, we find no evidence that any one approach to organising community nursing services; vertical integration; horizontal integration; or no structrural integration, outperfomed the other models in terms of emergency hospital use having adjusted for changes in population size, structure and deprivation.

# 7 Conclusion

Our analysis suggests that decisions taken in 2010/11 to structurally integrate community nursing services and the form of this integration (vertical or horizontal), did not systematically and differentially influence the rate of emergency hospital use of older people. Whilst a positive finding in favour of one approach might have been more striking, our result is still highly informative. It suggests that time consuming and costly mergers and organisational changes should not be confidently promoted or pursued as a means of reducing hospital activity. If organisational change must take place, then healthcare systems should have other compelling reasons for doing so. In this respect, our analysis supports the permissive approach set out in the *Five Year Forward View*, allowing local healthcare systems the freedom to develop their own approach of partnership working. It is important that this stance is sustained despite the temptation to impose to an organisational blueprint.

Other factors appear to play a more significant role in determining levels of emergency hospital admissions and more effort should be applied to identifying those critical ingredients robustly.

The NHS requires a more systematic and transparent approach to evaluating major change programmes.

# Technical Appendix

*Study design, setting and population*
We conducted a longitudinal ecological study using a balanced dataset of 1,400 observations; 140 primary care trusts for ten annual time periods (2006/7 to 2015/16). The 140 primary care trusts were those that adopted one of the following four models for community nursing services in 2010/11; community trust, community interest company, vertical integration with acute hospital provider and horizontal integration with a mental health provider.

*Variables and Data sources*
The outcome variables were the number of emergency hospital admissions and emergency hospital bed days. These variables were derived from an extract of the Hospital Episode Statistics for Admitted Patient Care dataset obtained from the Health and Social Care Information Centre. Emergency admissions and bed days were identified using the admission method field. The number of bed days were identified using the spell duration field. Admission and bed days were assigned to a year based on the patient's discharge date; and to PCT based on the patient's lower super output area (LSOA) of residence using the 2011 LSOA to PCT lookup file from the Office of National Statistics Geography Portal.

The explanatory variables included the resident population aged 75 and over, the proportion of the population aged 85 or over (of those aged 75+), levels social deprivation, year, and the organisational model adopted for community nursing services in 2011/12. In addition, variables were created to encode the number of years since the intervention, the adoption of a new service model for community nursing, (0 if before 2011/12, 1 if 2011/12, through to 5 if 2015/16).

The resident population aged 75 and over and 85 and over was obtained from the Office of National Statistics mid-year population estimates for LSOAs.

Social deprivation was defined using the 2010 English Indices of Deprivation for LSOAs. The deprivation level variable for a primary care trust was defined as the unweighted average deprivation score for lower super outputs areas within the primary care trust.

Year was converted to an integer variable from 0 for 2006/7 through to 9 for 2015/16.

The organisation model adopted for community nursing services in 2011/12 was taken from Spilsbury (2015). A design variable was constructed with three categories: no structural integration (community trust, community interest company); vertical integration with acute hospital provider; and horizontal integration with a mental health provider. Vertical integration with acute hospital provider, the largest group, was used as the reference category.

*Statistical Methods*
We used negative binomial regression to estimate the impact of the organisational model for community nursing on the number of emergency hospital admissions and bed days having adjusted for the explanatory variables. Given that we were interested in estimating and comparing the average effect on a PCT of adopting each of the organisational models, we used generalised estimating equations to estimate the parameter values. Robust standard errors were used to generate 95% confidence intervals for each of the model parameters.

The models contained three time-varying main effects: the proportion of the population aged 75 and over who are aged 85 or over minus the 10-year PCT-specific mean for this proportion; year; and years since intervention; and three time-invariant main effects: 10-year mean proportion of population aged 85 and over; deprivation level; and organisational model.

The model also contained three interaction terms between organisational model and year, before/after intervention and years since intervention. These interaction terms were used to identify and adjust for differences between organisational models in emergency admissions and bed day trends before, at the point of, and after the organisational models were adopted. These were our variables of interest.

Primary Care Trust was treated as a cluster variable. The population aged 75 and over was used as a time-varying offset variable.

Pairwise comparisons between the four organisational models were calculated for the variables of interest.

The quasilikelihood under the independence model criterion (QIC) was used to guide decisions about the optimal correlation structure.[23]

DFBeta values were calculated for all combinations of model coefficients and PCTs. Sensitivity analysis was conducted by assessing the stability of the model coefficients having removed those PCTs with the greatest leverage.

Data processing was conducted in Microsoft SQL Server 2012. Analysis was carried out in Stata IC version 15.1 statistical software package incorporating the QIC program developed by Cui.[24]

[23] Pan, W. Akaike's information criterion in generalized estimating equations. Biometrics 57: 120–125, 2001
[24] CUI, J, QIC program and model selection in GEE analyses, The Stata Journal 7, Number 2, 209-220, 2007

*Model Results*

A full set of estimated coefficients for the emergency admission and emergency bed day models are provided below. We present the models with a full set of candidate covariates. Some very small improvements in model fit (measured by the QIC), could be achieved by eliminating some variables.

*Emergency Admission Model*

| Covariate | | IRR | P>z | [95% Conf. Interval] | |
|---|---|---|---|---|---|
| Year | | 1.030 | 0.000 | 1.023 | 1.037 |
| % Pop 85+ | (10-yr PCT mean) | 0.477 | 0.114 | 0.190 | 1.194 |
| % Pop 85+ | (PCT trend) | 2.013 | 0.201 | 0.689 | 5.879 |
| Deprivation | | 1.011 | 0.000 | 1.009 | 1.013 |
| Years since intervention | | 0.978 | 0.000 | 0.969 | 0.986 |
| | | | | | |
| Org. Model | Vertical integration | 1.000 | - | - | - |
| | Horizontal integration | 1.011 | 0.646 | 0.965 | 1.059 |
| | No Structural integration | 0.944 | 0.018 | 0.899 | 0.990 |
| | | | | | |
| Org. Model * Year | Vertical integration | 1.000 | - | - | - |
| | Horizontal integration | 0.999 | 0.859 | 0.990 | 1.008 |
| | No Structural integration | 1.006 | 0.228 | 0.996 | 1.015 |
| | | | | | |
| Org. Model * Intervention | Vertical integration | 1.000 | - | - | - |
| | Horizontal integration | 0.999 | 0.936 | 0.986 | 1.013 |
| | No Structural integration | 0.996 | 0.571 | 0.982 | 1.010 |
| | | | | | |
| Intercept | | 0.309 | 0.000 | 0.236 | 0.405 |

*Emergency Bed-day Model*

| Covariate | | IRR | P>z | [95% Conf. Interval] | |
|---|---|---|---|---|---|
| Year | | 0.979 | 0.001 | 0.968 | 0.992 |
| % Pop 85+ | (10-yr PCT mean) | 0.664 | 0.547 | 0.175 | 2.521 |
| % Pop 85+ | (PCT trend) | 9.989 | 0.009 | 1.784 | 55.942 |
| Deprivation | | 1.011 | 0.000 | 1.008 | 1.014 |
| Years since intervention | | 1.003 | 0.661 | 0.989 | 1.017 |
| | | | | | |
| Org. Model | Vertical integration | | | | |
| | Horizontal integration | 1.036 | 0.446 | 0.946 | 1.133 |
| | No Structural integration | 0.898 | 0.006 | 0.832 | 0.970 |
| | | | | | |
| Org. Model * Year | Vertical integration | | | | |
| | Horizontal integration | 0.988 | 0.132 | 0.972 | 1.004 |
| | No Structural integration | 1.004 | 0.622 | 0.990 | 1.018 |
| | | | | | |
| Org. Model * Intervention | Vertical integration | | | | |
| | Horizontal integration | 1.010 | 0.300 | 0.991 | 1.030 |
| | No Structural integration | 0.995 | 0.628 | 0.977 | 1.014 |
| | | | | | |
| Intercept | | 3.818 | 0.000 | 2.538 | 5.744 |

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