Impact of Urgent and Emergency Care Vanguards on Delayed Transfers of Care in England

Gintare Malisauskaite (G.Malisauskaite@kent.ac.uk)
University of Kent https://orcid.org/0000-0002-0797-5949

Karen Jones
University of Kent

Stephen Allan
University of Kent

Daniel Roland
University of Kent

Yvonne Birks
University of York

Kate Baxter
University of York

Kate Gridley
University of York

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Gintare Malisauskaite*[1], Karen Jones[1], Stephen Allan[1], Daniel Roland[1], Yvonne Birks[2], Kate Baxter[2], Kate Gridley[2]

*Correspondence: G.Malisauskaite@kent.ac.uk
Personal Social Services Research Unit (PSSRU), University of Kent, Office CC228, Cornwallis Central, Canterbury, CT2 7NF, UK

[1] Personal Social Services Research Unit (PSSRU), School of Social Policy, Sociology and Social Research (SSPSSR), University of Kent, UK
[2] Social Policy Research Unit (SPRU), Department of Social Policy and Social Work, University of York, UK

Abstract

Objectives: To assess the relationship between Urgent and Emergency Care (UEC) Vanguards, which include as an aim the integration of healthcare and social care sectors, and Delayed Transfers of Care (DTOC) at Local Authority level in England.

Methods: Difference-in-difference pooled cross section, fixed and random effects panel estimations were used to compare DTOC between UEC partner site Local Authorities with non-UEC Local Authorities employing quarterly data on days of DTOC from Local Authorities in England for the period 2010 to 2017. Robustness checks included employing a range of sample and variable specifications and synthetic control estimations.

Results: A statistically significant negative relationship was found between UEC Vanguards and DTOC rates that is robust to various specification checks with no indication of UEC participant sites having lower DTOC rates prior to the start of the initiative.

Conclusions:

UEC Vanguards appear to be associated with up to 40.5% lower DTOC rates at 1% significance level compared with other English Local Authorities. The empirical evidence indicates a statistically significant impact; however, more research is required to explain the reasons for this relationship.

Keywords:

Delayed Transfers of Care, Urgent and Emergency Care Vanguards, integration policy

Background

Delayed Transfers of Care (DTOC) is a term used to describe situations where patients are medically fit to be discharged from a hospital to home or further care settings but the process is delayed (1, 2). DTOC has attracted increased attention from policy makers and health and social care professionals (3), due to recent increases, an estimated £820 million annual cost (4), and delayed hospital discharge being associated with decreased subsequent participation in activities of daily living, frailty, increased age, high comorbidity, cognitive impairment, and dependency (5-11).

Attempts to address the costs associated with DTOC have inspired some innovative policy approaches to integrating social and health care over the last few years, including Better Care Fund (12), Integrated Care Pioneers (13) and recently New Models of Care – Vanguards (14). Vanguards set out to help improve integration of services with five different approaches (14):

- *Acute care collaboration* – link local hospitals to improve clinical and financial viability.
- *Urgent and emergency care* – improve coordination of services and reduce pressure on A&E departments.
- *Enhanced health in care homes* – improve and integrate health, care and rehabilitation services for older people in care homes.
- *Multi-speciality community providers* – move specialist care into the community from hospitals.
- *Integrated primary and acute care systems* – join up GP, hospitals, community and mental health services.

This paper examines the relationship between Urgent and Emergency Care (UEC) Vanguards and DTOC rates specifically, since discharge planning from acute care was identified as one of the challenges by the UEC Vanguards (15). Since DTOC may be directly affected by the effectiveness of communication between health and social care providers, DTOC rates may be a useful proxy for some aspects of integration. DTOC has previously been used as a criterion for evaluating the success of health and social care integration policy initiatives (16).

There were eight different UEC Vanguards announced to take effect between July-August 2015 and these ended in March 2018. The programme was aimed at improvement of national and local urgent and emergency care services. This mainly involved administering a new model of integrated urgent care accessed through NHS 111 alongside developing a Channel Shift modelling tool to facilitate service planning and design. The latter, especially, was aimed at further integration and cooperation between health, social and community care services, and included planning for discharge from the hospital from the point of admission (14-15). For this reason we determined there to be sufficient rationale for testing any relationship between Vanguards and delayed discharges from hospitals.

To date, research related to DTOC is somewhat scarce. Most research considers challenges related to the discharge of older people: appropriate future support, suitable discharge destinations, and how policies are put into practice (17-20), and how lack of social care supply may increase DTOC (21). Concerns over the integration of services in general are also considered (22,

23). As part of a wider study examining the role of social care in DTOC (24) we examined the link between UEC Vanguards and DTOC rates.

Methods

Data were collected for 150 English Local Authorities (here onwards – LAs, excluding City of London and Isles of Scilly (due to stark differences and size in comparison to other LAs) for the time period between 2010 quarter 4 and 2017 quarter 4 (150 LAs, 29 quarters, 4,350 observations). The analysis was carried out at an aggregated level due to the availability of some control variables and the analysis time frame was chosen based on the availability of DTOC data at the time of analysis. The datasets were combined using Local Authority codes and time information. The model specification used to assess the effect of Vanguards on DTOC built on that developed in Roland et al. (25) with minor adjustments:

$$DTOC_{it} = \alpha_i + V_{it}\beta_1 + C_{it}\beta_2 + u_{it} \quad (1)$$

Where the dependent variable $DTOC_{it}$ is expressed either as number of DTOC days (including all delayed discharge days) or as its natural logarithm. Both expressions of the dependent variable were used in regressions, but analysis mainly relies on the logarithmic transformation. Subscript i indicates a Local Authority, t time, in quarters and α is a constant. The eight UEC Vanguards took effect in August 2015 (quarter 3) and included 29 Local Authorities as partners (14). The start date of UEC Vanguards was nominal, but without more precise information of exact timings of where the programmes took effect in different locations, or when it is likely we could

observe changes in outcomes and considering the quarterly nature of our data used, it was deemed sufficiently accurate for the purposes of our analysis. Vanguard partners were identified using the dummy variable V_{it} (1 = after implementation, 2015 quarter 3, 0 = before or not this Vanguard partner), and β_1 is the coefficient of interest for the analysis, showing the average effect of being a partner in the UEC Vanguards on DTOC. Finally, C_{it} is a vector of control variables, with β_2 being a vector of coefficients associated with them, representing the effects they have on DTOC rates.

The analysis controlled for the following factors associated with LA-level DTOC: demographics and needs (carer's allowance, disability living allowance, total population in LA, and percentage of population above 65 years old), LA structure (type, size in square metres, percentage of people living in rural areas, the number of Clinical Commissioning Groups (CCGs) each LA is in partnership with, and care home bed supply), economic variables (jobseeker's allowance, pension credit, house prices, percentage of older people who own houses with mortgages, and percentage of older people who own houses outright). The control variables were chosen based on the findings from the literature regarding confounders of delayed discharges from hospitals and data availability. Further details of the data are available in Appendix Table A1.

Equation (1) was estimated using OLS, Difference-in-Difference pooled cross section , but we also take into account the panel nature of the data using fixed effects and random effects models (26, p. 285). All regressions used cluster-robust standard errors centred at LAs, to account for potential heteroscedasticity and unobservables, relevant to each LA, not included in

the model, and year dummies for each year since 2010. Total number of days of DTOC and its natural logarithm were both used as the dependent variable, the latter was preferred because of the skewed distribution of DTOC. A Hausman test found that fixed effects model was preferred to random effects in the main specification, although results with the latter specification were comparable (results in Table 3). Given the time invariant nature of some data (e.g. type, size), the random effects model included all of the control variables.

Synthetic control estimations (27-28) were run as a robustness check. This method allows creating a control unit that matches the main characteristics of the treated unit. This creates a unit that mimics the treated unit as closely as possible prior to the treatment, in this case – UEC Vanguard programme start. Further, normal procedure to achieve close tracking between the two units also includes controlling for the outcome variable prior to the treatment. By treated unit we refer to a derived average of all UEC Vanguard partner sites, 29 Local Authorities, and all of their control variable characteristics. The control unit is created from the rest of LAs in England selecting different weights for LAs to account for changes in confounding variables over time. This allowed for a more credible prediction of the counterfactual i.e. there is an element of precision added when comparing the treated unit with the created composite untreated unit.

Results

[Table 1]

[Table 2]

Descriptive statistics

Table 1 gives descriptive statistics. From the last quarter of 2010 to the last quarter of 2017, the average number of DTOC days was 2,755 per English LA per quarter. 6.7% of the sample observations were UEC Vanguard partner sites. Table 2 provides more detail on outcome and control variables based on participation in UEC Vanguard programme and their means before and after its start.

[Figure 1]

Figure 1 compares average number of DTOC days (ratio to LA population) per quarter for LAs in UEC Vanguards compared to those not in UEC Vanguards. The increase in DTOC days after the start of the UEC programme, obvious for the non-UEC LAs, was hardly visible for LAs in UEC Vanguards, giving some potential indication of non-parallel trends, which we assessed in robustness checks to the main results.

Fixed effects panel regression

Table 3 reports the main results from the pooled cross-section, fixed and random effects panel regression estimations in column 1. The relationship between the UEC Vanguards and DTOC is consistently negative and statistically significant. In the preferred specification, UEC Vanguards are associated with up to 40.5% lower DTOC rates at 1% significance level (95% confidence interval: 22.4 – 58.5%). Reduction in DTOC is larger when estimated with fixed effects (FE) than with the pooled cross-section (1063 days vs. 863 and 40.5% vs. 25.3%). This is likely due to FE accounting for differences between panel units over time, separating and capturing the relationship with UEC better.

[Table 3]

Robustness checks

Table 3 also presents some of the robustness checks we employed. Many specifications were run with different sets of control variables to observe how the coefficient size changes with each. The effect size associated with UEC Vanguard initiative stays fairly stable and highly statistically significant throughout different specifications. For simplicity, we report only one additional specification results (column 2) where we control only for yearly dummies only in addition to the UEC Vanguard binary variable. In this specification the random effects model is preferred, which controls for unobserved heterogeneity across LAs. However, the size of the effect is extremely comparable to the fixed effects model – both models showing a 35.9% reduction in DTOC being associated with UEC Vanguard.

One of the possible interpretations for the observed results may be that sites participating in UEC Vanguards could have been selected based on better DTOC rates, i.e. the potential for non-parallel trends in DTOC. There is no publicly available information of specific selection criteria so we tested for any statistical differences by running the model (1) using two modifications:

a) without identifying the start of the UEC Vanguard, checking for an overall difference between UEC participating sites and others over the entire period of time of data (column 2);

b) using only data prior to 2015, the start of the initiative (column 3).

The findings show there was no statistically significant relationship between UEC Vanguards and DTOC in these alternative specifications. This suggests that non-parallel trends of DTOC are not driving the finding,

These robustness checks do not prove a lack of selection bias into the UEC Vanguards for reasons other than lower DTOC rates. ,.As such, finally, we usedthe synthetic control modelling approach to account for any selection criteria that could have been related to the variables we controlled for in the analysis.

[Figure 2]

Figure 2 depicts the predictions of synthetic control estimations. The figure shows that since the beginning of UEC Vanguards partner sites had consistently lower average DTOC rates than would be predicted without the Vanguards, and the difference is sizeable (in line with FE (estimation outcome matrices provided in Table A2 in the Appendix). The synthetic control unit tracks the data prior to UEC fairly well (the predictor balances available at Table A3 in the Appendix), which indicates a good fit of the model and its adequacy.

However, synthetic control estimation cannot account for a level of natural uncertainty in the produced estimates. The significant dip in DTOC days just prior to the start of UEC Vanguards suggests that some form of preparation with regard to integration and DTOC could have taken place in the participating sites.

Discussion

Main findings

Our findings suggest that LAs that were part of UEC Vanguards had significantly lower than average DTOC than non-UEC sites after the start of the programme. Overall DTOC rates rose substantially in the second quarter

of 2015 until the end of 2016, potentially explained by severe cuts to social care (29), however, they rose significantly less in UEC Vanguard sites. After controlling for confounders, we found no evidence suggesting that UEC Vanguard sites had lower DTOC rates prior to becoming Vanguards but are unable to rule out the possibility that they might have been in a better position to reduce DTOC due to other as yet unidentified factors, e.g. other health care programmes already in place in the UEC partner LAs.

It is difficult to pinpoint the reasons why UEC Vanguards influence DTOC rates, even if synthetic control estimation results suggest a potential causality. However, one potential explanation from policies and initiatives associated with being in a Vanguard is the channel shift modelling tool which supports integration of services, communication and cooperation between hospital and community based services (30). Channel shift interventions include planning discharge from time of admission, discharging for further assessment ('discharge to assess') and rapid response services. There are no other studies looking into the relationship between New Models of Care – Vanguards and DTOC rates, however, there is some evidence that Vanguards are associated with a small reduction in hospital admissions (31). The move towards greater integration of services is not a new thought, and importance of local collaboration has been consistently stressed (32). This is particularly important in regards to potential changes COVID response has led to, including hospital discharge service, which is expected to influence the further development of discharge to assess and integration of health and social care services (33). Alongside our findings, this indicates that the New Models of Care – Vanguards programme should be of interest to policy makers

as the programme may have helped meet policy targets and reduced costs. Consequently, detailed analyses regarding specifics of UEC Vanguards should be carried out in future research.

Limitations

Despite using modelling which allowed for heterogenous differences between LAs and synthetic control estimation results suggesting an element of causality between UEC participation and DTOC rates, we refrain from making this claim fully due to multiple factors that could not be accounted for in our analysis.. There is no publically available information on the criteria of selection into different Vanguards, which might inform explanations and analysis. Further work on specific policies used within UEC Vanguard sites, including qualitative analysis and more details on UEC Vanguards' specifics could help untangle potential reasons for the association between UEC Vanguards and DTOC.

Additionally, this analysis does not account for different times UEC Vanguards took effect in different locations, or differences within the eight UEC Vanguards, or possible different levels of exposure to UEC Vanguard influence in each LA. We anticipate there is some variation in associations between different UEC Vanguards and outcomes. However, this approach should be sufficient to show the average effect of the UEC Vanguards programme. The identified limitations could be further routes of enquiry, even if achieving precision in quantifying health care programmes is unlikely.

A potential solution would be to use individual level data to conduct a similar type of analysis. This could allow more precise estimation of the effect

size as case-specific confounders could be taken into account, which is not possible at an aggregated level. However, with the information available, our estimation method seemed appropriate to reveal any associations for policy-informing purposes.

Conclusions

The introduction of the UEC Vanguards seems to be related to significantly lower DTOC for UEC partner sites, highlighting important implications for the National Health Service and social care, alongside individuals discharged from hospital. However, it is difficult to isolate the impact of the UEC Vanguards from other Government integration policies, together with the austerity climate facing the care sector.

Abbreviations

UEC: Urgent and emergency care vanguard;

DTOC: delayed transfers of care;

OLS: Ordinary least squares;

LA: Local Authority;

CCG: Clinical Commissioning Group;

FE: Fixed effects panel regression model.

Declarations

Ethics Approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

GM conceived the statistical methodology, performed the statistical analysis and drafted the manuscript; KJ contributed to the conception, study design and the final writing of this paper; SA contributed to the study design, statistical methodology and the final writing of this paper; DR contributed to the statistical methodology and the final writing of this paper; YB critically revised the draft and contributed to the final writing of this paper; KB critically

revised the draft and contributed to the final writing of this paper; KG critically revised the draft and contributed to the final writing of this paper.

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[Appendix]

Tables and Figures

Table 1: Descriptive statistics

Variable	Mean	Min/Max
Dependent variables:		
DTOC days	2755.394	0/26733
DTOC(log)	7.438	0/10.194
Explanatory variables:		
UEC Vanguard	0.067	0/1
JSA ratio	0.026	0.001/0.09
PC ratio (65+)	0.235	0.062/0.691
CA ratio	0.011	0.004/0.027
DLA ratio (65+)	0.087	0.025/0.257
Care home beds (log)	7.553	5.451/9.461
Population (log)	12.598	10.519/14.257
Population 65+ ratio	0.166	0.06/0.286
Rural or hub (%)	17.507	0/100
No. CCGs to LA	5.660	1/21
House prices (£, log)	12.343	11.443/14.62
Owning house ratio (65+)	0.075	0.013/0.126
Owning house outright ratio (65+)	0.069	0.011/0.115
Area(m^2)	86839.430	1213/803761
CCG dummy	0.655	0/1
LA type:		
Metropolitan	0.240	0/1
London	0.213	0/1
County	0.180	0/1
Year:		
2010	0.034	0/1
2011	0.138	0/1
2012	0.138	0/1
2013	0.138	0/1
2014	0.138	0/1
2015	0.138	0/1
2016	0.138	0/1
2017	0.138	0/1
No of obs.	4,350	

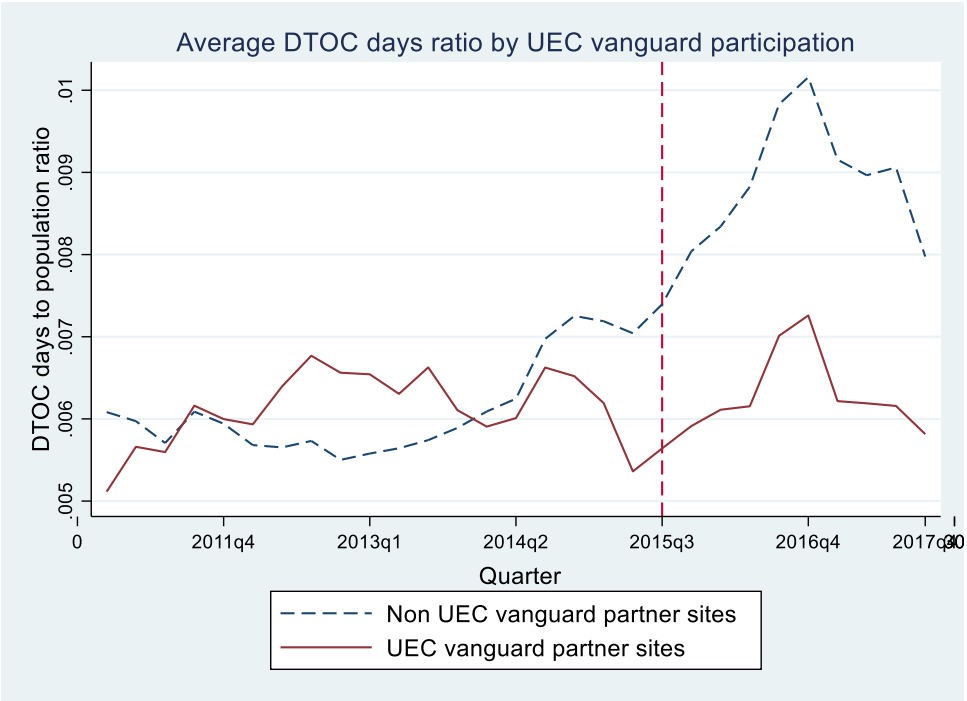
Table 2: Descriptive statistics by UEC Vanguard partner – before and after means

	Non-UEC		UEC	
	Before	After	Before	After
DTOC days	2510.955	3690.847	2130.523	2233.072
DTOC(log)	7.344334	7.758407	7.255489	7.297711
JSA ratio	0.031272	0.012509	0.038485	0.016309

PC ratio (65+)	0.254087	0.190102	0.263469	0.19152
CA ratio	0.010333	0.012434	0.011437	0.014433
DLA ratio (65+)	0.087383	0.080628	0.097996	0.090038
Care home beds (log)	7.521928	7.535296	7.666286	7.666745
Population (log)	12.60945	12.63799	12.5038	12.52737
Population 65+ ratio	0.161205	0.168712	0.174282	0.183642
House prices (£, log)	12.34778	12.52908	12.03327	12.17675
Rural or hub (%)	16.31793		22.46746	
No. CCGs to LA	5.752066		5.275862	
Owning house ratio (65+)	0.074886		0.077415	
Owning house outright ratio (65+)	0.068836		0.071335	
Area(m^2)	83452.44		100971.3	
No of obs.	2,420	1,210	551	290

Note: Before – 2010 q4 to 2015 q2, 19 quarters; After – 2015 q3 to 2017 q4, 10 quarters.

Figure 1: Average DTOC days over time



Note: UEC Vanguard partner sites include 29 LA's (12).

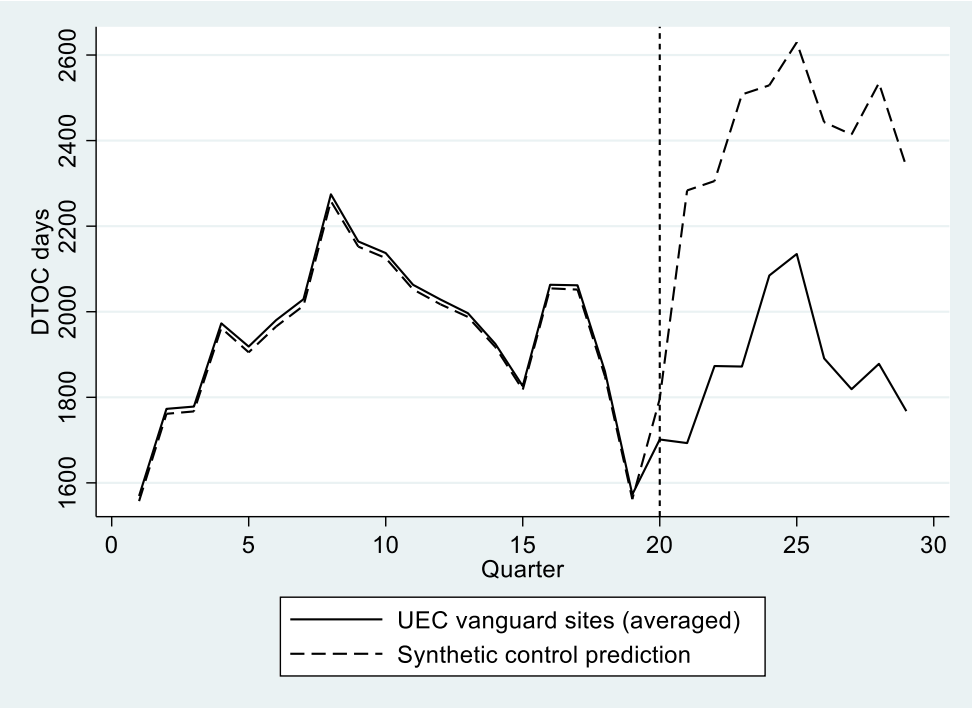
Table 3: Relationship between UEC Vanguards and DTOC

Estimation method	Dependent variable	1)	2)	3)	4)
Pooled cross-section	DTOC (days)	-862.935***	-1396.332***	-322.209	180.772
		(284.705)	(524.947)	(243.911)	(218.522)
	DTOC (log)	-0.253***	-0.442**	-0.047	0.132
		(0.088)	(0.176)	(0.079)	(0.095)
Panel regression, FE	DTOC (days)	-1063.251***	-1029.246***	-	-
		(253.854)	(237.019)		

	DTOC (log)	**-0.405*** **	-0.359***	-	-
		(0.091)	(0.093)		
Panel regression, RE	DTOC (days)	-1008.099***	-1032.686***	-501.535*	154.002
		(237.91)	(237.991)	(378.071)	(228.777)
	DTOC (log)	-0.372***	-0.359***	-0.044	0.147
		(0.087)	(0.092)	(0.086)	(0.096)
Hausman test	DTOC (log)	63.44***	0.22		
Breusch-Pagan LM test			40829.93***		
Number of obs.		4350	4350	4350	2550

Note: Columns: 1) Main specification, exploring effects of different estimators and expressions of the dependent variable, main result in bold; 2) Specification including only UEC dummy variable and time effects; 3) UEC Vanguard sites are identified with a binary variable without distinguishing the starting point of this Vanguard; 4) same as 3) only using sample prior to 2015.
Other variables included in the estimations but not in the table above include LAs' demographics, structure, benefits, other economic variables and year dummies, specified in Methodology section; more details of variable construction available in the Appendix.
Robust standard errors in parentheses.
'-' due to fixed effects nature of the model and binary UEC Vanguard variable being uniformly 1 for specific LAs across the samples 3) and 4), coefficient not reported.
*** - p<1%, ** - p<5%, * - p<10%

Figure 2: Synthetic control estimations



Appendix

Table A1: Definition of variables

Variable	Explanation	Frequency	Source
Dependent:			

DTOC (days)	Number of days any patient experienced delayed discharge from hospital	Q	NHSE/I
DTOC (log)	Natural logarithm of DTOC(days)	Q	NHSE/I
Explanatory:			
UEC Vanguards	1 if one of 29 LA's participating in this Vanguard and it is onwards and after 2015 quarter 3, 0 – otherwise	F	NHSE/I
Care home beds(log)	Natural logarithm of the number of care home beds available in the LA	A	CQC
CA Ratio	Percentage of all population that receives Carer's Allowance	Q	ONS
DLA Ratio(65)	Percentage of older population (65+ years) that receives Disability Living Allowance	Q	ONS
JSA Ratio	Percentage of all population that receives Jobseeker's Allowance	Q	ONS
PC Ratio(65)	Percentage of older population (65+ years) that receives Pension Credit	Q	ONS
Population(log)	Natural logarithm of the LA's population	A	ONS
65+ ratio	Percentage of older people (65+) in the population	A	ONS
House prices(log)	Natural logarithm of average house prices in LA	Q	LandReg
Owned house	Percentage of older people (65+) that own a house with mortgage, 2011 data	F	ONS
Owned house (outright)	Percentage of older people (65+) that own a house outright, 2011 data	F	ONS
LA type	Type of Local Authority: Metropolitan, Unitary, London and County	F	Gov
Area	Local Authority's size (m^2)	F	Gov
Rural and hub ratio	Percentage of people living in rural areas and hub towns, 2011 data	F	ONS
CCGs per LA	Number of CCGs each LA is interacting with	F	Gov
CCG dummy	1 – April 2013 onwards, identifies creation of CCG's, 0 – before April 2013	F	Gov

Note: Q – quarterly, A – annual, F – fixed; NHSE/I – NHS England and Improvement, CQC – Care Quality Commission, ONS – Office for National Statistics, LandReg – HM Land Registry's Price Paid Data, Gov – UK government's online service.

There were no missing values for all data points used throughout the chosen study time period.

Table A2: Synthetic control estimation outcome (DTOC) measures by period:

Period	DTOC days Treated	DTOC days Synthetic	Difference
1	1569.36	1557.42	-11.938
2	1772.96	1761.47	-11.488
3	1778.4	1767.08	-11.316
4	1972.96	1961.93	-11.034
5	1918.64	1905.17	-13.474
6	1980.32	1965.48	-14.836

7	2029.24	2014.04	-15.199
8	2274.52	2258.35	-16.171
9	2164.28	2152.22	-12.065
10	2137.16	2125.54	-11.62
11	2062.92	2052.17	-10.752
12	2028.56	2017.39	-11.175
13	1996.64	1987.86	-8.779
14	1924.96	1917.51	-7.446
15	1826.32	1817.59	-8.735
16	2063	2054.71	-8.288
17	2061.84	2051.76	-10.076
18	1860.92	1849.25	-11.666
19	1573.04	1561.97	-11.075
20	1701.48	1796.38	94.902
21	1693.04	2283.54	590.501
22	1873.08	2305.43	432.352
23	1871.88	2507.84	635.96
24	2084.72	2529.18	444.455
25	2135	2629.65	494.654
26	1890.96	2443.09	552.133
27	1819	2414.3	595.298
28	1878.28	2534.68	656.396
29	1767.72	2338.69	570.973

Table A3: Synthetic control estimation predictor balance:

Variable	Treated	Synthetic
JSA ratio	0.039029	0.039353
PC ratio (65+)	0.269154	0.274212
CA ratio	0.011704	0.012411
DLA ratio (65+)	0.098542	0.106904
Care home beds (log)	7.602731	7.384806
Population (log)	12.43287	12.34926
Population 65+ ratio	0.173527	0.164379
Rural or hub (%)	20.8956	15.11042
No. CCGs to LA	4.84	4.199
House prices (£, log)	12.03679	11.95333
Owning house ratio (65+)	0.077565	0.076044
Owning house outright ratio (65+)	0.071337	0.070068
Area(m^2)	79959.32	96370.46

Figures

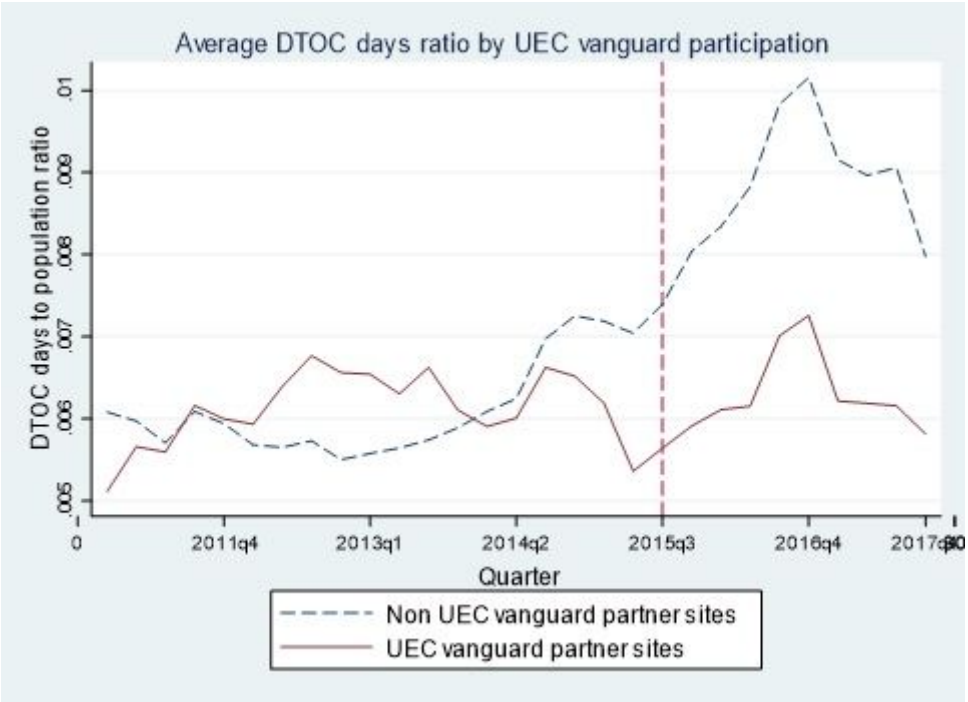


Figure 1

Average DTOC days over time. Note: UEC Vanguard partner sites include 29 LA's (12).

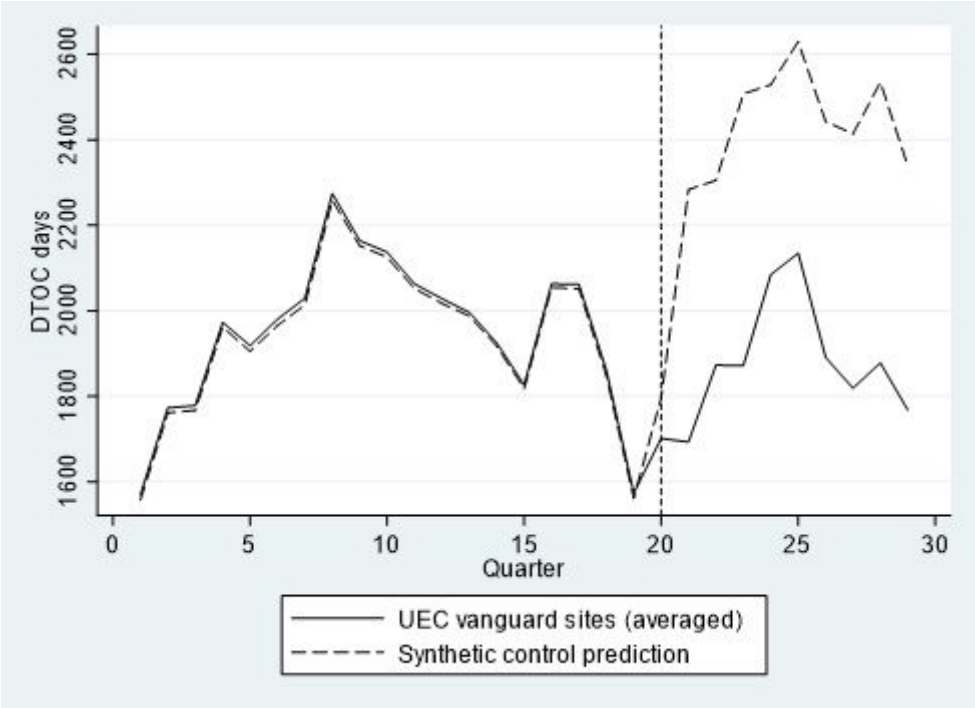


Figure 2

Synthetic control estimations