Social Science & Medicine 307 (2022) 115188

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Does vertical integration of health and social care organizations work? Evidence from Scotland

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ARTICLE INFO

Keywords:
Health and social care integration
Healthcare outcomes
UK
Quasi-experiment
Quantitative analysis

ABSTRACT

Vertical integration of health and social care organizations is widely regarded as an effective way to deliver improved outcomes for recipients of the services provided by those organizations. We test this hypothesis by investigating the impact of the creation of integration authorities in Scotland – statutory bodies responsible for planning and resourcing adult social care, primary care, community health and unscheduled hospital care at the local level. Employing a difference-in-difference style analysis we compare delayed discharges and premature mortality rates in Scottish integration authorities with those for local authority areas in the North of England for the period 2013–2019. The results suggest that health and social care integration led to improved performance on delayed discharges in Scotland (point estimate, −0.236; 95% confidence interval, −0.443, −0.029), but that premature mortality rates remained unchanged. These findings suggest that the vertical integration of local health and social care organizations may enhance organizational efficiency and patient experience, but that improvements on broader indicators of population health are more difficult to achieve.

1. Introduction

Policy-makers and researchers increasingly argue that closer integration of the services provided by healthcare and social care organizations is vital for improving system efficiency and effectiveness, as well as population health outcomes (Glasby, 2017: OECD, 2017). Ranging from full vertical integration of the organizations responsible for health and social care to decentralized horizontal service-delivery networks (Kodner and Spreeuwenberg, 2002), an array of alternative integration schemes has been proposed and introduced by countries across the globe (see Looman et al., 2021; Robertson, 2011). Within the UK, each of the four 'home' countries has moved the integrated care agenda forward in strikingly different ways (Kaehne et al., 2017). In particular, Scotland, where adults with critical or substantial care needs receive free personal care, has created statutory integration authorities, which manage primary care, social care, community health and unscheduled hospital care (Hendry et al., 2016). Such a vertical integration scheme promises enhanced outcomes because when the governance, planning and resourcing of health and social care are carried out by the same organization, improved service co-ordination is assumed to be inevitable (Ramsay et al., 2009; Reed et al., 2005). However, surprisingly little research has investigated whether vertical integration delivers improved outcomes for service recipients.

To date, much of the research dealing with health and social care integration has sought to identify the enablers and barriers associated with implementing integration schemes (e.g. Lalani et al., 2020; Looman et al., 2021; Pearson and Watson, 2018; Stoop et al., 2019). Nevertheless, scholars are increasingly interested in whether such schemes result in improvements in the population health, patient experience and healthcare costs that are regarded as the Triple Aim of healthcare systems (Berwick et al., 2008).

Systematic reviews of international evidence dealing with the effects of any type of integration within a healthcare system highlight the mounting effort to evaluate whether integration can work (e.g. Baxter et al., 2018; Liljas et al., 2019). More recently, studies have begun to address the issue of organizational integration schemes within different healthcare systems. In the United States, researchers have investigated the impact of Accountable Care Organizations, corporate entities that bring together several independent providers, on patient outcomes (for a review, see Kaufman et al., 2019). In the UK, Stokes et al. (2021) investigate the impact of integrated care partnerships on health status, patient experience and costs in two English local authorities, while

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https://doi.org/10.1016/j.socscimed.2022.115188
Received 28 January 2022; Received in revised form 23 June 2022; Accepted 28 June 2022
Available online 3 July 2022

Morciano et al. (2020) and Morciano et al. (2021) analyze the impact of multiple models of integrated care on hospital utilisation in England. To contribute empirical evidence to these emerging debates about the value of integrated care, we analyze the efficacy of Scotland's distinctive vertical health and social care integration scheme.

According to organizational theory, vertical integration of the productive functions within an organization involves the elimination of separate contractual exchanges with outside parties, through complete ownership and control of all the stages of production (or distribution) (Perry, 1989). Full integration of intra-organizational production processes is assumed to result in administrative economies, improved co-ordination of activities, faster decision-making and greater purchasing power (Harrigan, 1984). Vertical integration of the adjacent productive functions of separate organizational entities can occur through mergers and consolidations, which are presumed to reduce the risks associated with incomplete contracts, especially the high transaction costs relating to asset specificity (Grossman and Hart, 1986). At the same time, vertical integration can permit the pooling of separate organizational budgets, thereby generating economies of scope (Panzar and Willig, 1981). Within healthcare systems this can facilitate the internalisation of complex inter-organizational interdependencies relating to resource allocation (Mason et al., 2015).

Although the process of organizational integration can spawn unwanted transition costs due to the disruption to existing routines and practices (Hannan and Freeman, 1984), the full integration of health services within public healthcare systems remains a common aspiration (Toth, 2020). Healthcare systems are reliant on uniquely complex organizational interdependencies (Charns and Tewksbury, 1993). Vertical integration of separate health and/or care organizations through consolidation, merger or common ownership may therefore represent an especially appealing way for policy-makers to address the needs of people with "severe and unstable conditions requiring intensive, ongoing medical and social attention from a host of providers for relatively long duration" (Kodner and Spreeuwenberg, 2002: 4).

To understand whether vertical integration is an effective approach for improving health and social care outcomes, we compare delayed discharges and premature mortality rates in Scottish integration authorities with those observed for the local authority areas across the North of England for the period 2013–2019. In this context, delayed discharges are a case management outcome that capture administrative efficiency and patient experience by reference to the postponed release of hospital patients who are clinically ready to leave because the necessary post-hospital care and support is not in place (DeVolder et al., 2020). Premature mortality rates represent a population health outcome that captures the impact of socio-economic deprivation on health inequalities via reference to the number of deaths among the local population aged under-75 (Thomas et al., 2010). These two outcomes are primary objectives of the vertical integration scheme in Scotland. Both are included among the core suite of performance indicators through which the Scottish government evaluates the success of health and social care integration (Scottish Government, 2015a). They are also measures closely tied to the activities co-ordinated by integration authorities.

Since 2015, Scottish integration authorities have had a statutory responsibility for resourcing and co-ordinating the primary, social, community and unscheduled hospital care required to achieve improvements in delayed discharges and premature mortality rates. They are also expected to include service user, carer and community representatives within their governance arrangements (Scottish Government, 2015a). Integration in Scotland is guided by an emphasis on anticipatory and preventative care, as reflected in the Scottish government's commitment to free needs-based personal care for over 65s established in 2002 and later extended to all adults in 2019. By contrast, in England, while horizontal networks of integration are encouraged, clinical commissioning groups (CCGs) currently retain responsibility for the management of primary healthcare, with local authorities still responsible for co-ordinating adult social care provision. Eligibility for personal care is both needs and means-tested in England, with proportionally fewer adults of all ages receiving state-funding for their care and support than in Scotland (https://www.nuffieldtrust.org.uk/comment-series/adult-social-care-in-the-four-countries-of-the-uk).

The variation in each country's approaches to health and social care integration enables us to employ a difference-in-differences style analysis to examine whether vertical integration of health and social care works. Moreover, by analysing delayed discharges and premature mortality we can shed light on those dimensions of system performance where vertical integration might work best. Our analysis suggests that the vertical integration of health and social care organizations appears to have resulted in improvements in administrative efficiency and patient experience – an effect that is especially pronounced after the initial bedding-down period. However, we find little evidence of improvements in population health/disparities. These results therefore provide qualified support for the benefits of vertical health and social care integration.

2. Health and social care integration

Reviewing the main approaches to integrating health and social care, Kodner and Spreeuwenberg (2002: 2) highlight that the meaning and logic of integration should be seen as "a step in the process of health systems and health care delivery becoming more complete and comprehensive". There are many different ways in which the process of integration can be achieved, including: pooling of funds; strategic planning; functional and organizational consolidations; joint commissioning; service co-location; joint programs; centralised case management and information systems; multi-disciplinary teams; shared diagnostic procedures; and, patient involvement (Kodner and Spreeuwenberg, 2002).

To better understand the different dimensions of health and social care integration, Nolte and McKee (2008) usefully distinguish between the type, breath, degree and process of integration. From this perspective, there are four main types of integration within healthcare systems: functional (i.e. co-ordination of support functions, such as planning, finance and IT); organizational (i.e. creation of networks, mergers or joint contracts); professional (i.e. joint-working between different groups of healthcare specialists); and, clinical (i.e. co-ordination of patient-centred services). Each of these types of integration can occur horizontally (i.e. across the same level within the system) or vertically (i.e. across different levels within the system). Integration can potentially involve the full co-ordination of activities within a single entity or ad-hoc collaboration between multiple separate entities. It can take place through four main processes: structural changes (i.e. new roles and functions); cultural changes (i.e. new norms and values); social changes (i.e. new relationships); or goal-based changes (i.e. new objectives and resources).

To date, most countries have introduced integration schemes intended to promote horizontal professional or clinical collaborations between the different service providers and professionals responsible for addressing the needs of vulnerable elderly people. These schemes have been based mainly around the articulation of shared goals, requiring minimal structural, cultural or social changes. In particular, small-scale localised programmes focused on provider networks, shared case management and service co-location have been implemented in many European countries (Looman et al., 2021).

In the UK, efforts to promote integrated care focused first on clinical collaborative initiatives to promote joined-up services at the local level, invariably with an emphasis on the need for cultural change. Joint hospital discharge protocols and joint strategic needs assessments brought together senior managers to establish shared priorities and procedures, with healthcare and social care professionals thereafter expected to respond positively to exhortations to work together (Heenan and Birrell, 2017). At the same time, in England, Integrated Care Pilots initiated in 2009 largely focused on bottom-up innovations in clinical

service delivery (Ling et al., 2012). More recently though, functional processes for joint-working at the strategic level, such as the Better Care Fund, have been supplemented with policies aimed at embedding collaborative professional and clinical practices at the operational and organizational level, such as the Pioneer and Vanguard pilot programmes piloted (Exworthy et al., 2017). Although the UK government is currently planning to establish statutory Integrated Care Boards and statutory Integrated Care Partnerships in England (Department for Health and Social Care, 2022), to date, it is only in Scotland and Northern Ireland that institutional structures for the comprehensive vertical integration of health and social organizations have been implemented (Kaehne et al., 2017).

In Scotland, the establishment of integration authorities merging health boards and local authorities on a statutory basis has created a single point of accountability for the performance of integrated services, whereas in England and Wales partnership arrangements remain in place between CCGs and health boards and the local authorities responsible for social care. In Northern Ireland, five health and social care trusts are responsible for all the services provided to the population, and as such there is no National Health Service. Nevertheless, evaluations of the effectiveness of the Northern Irish trusts as a comprehensive integration scheme are complicated by the absence of a deliberate strategy for improving integration within that structure (Kaehne et al., 2017). In Scotland, integration authorities were established with the express purpose of achieving improvements on a series of outcomes associated with better service integration, especially the quality of the service for people receiving care, delayed discharges and premature mortality rates (Scottish Government, 2015b).

To achieve performance improvements, Scottish health boards and local authorities allocate integration authorities a pooled budget of all the resources available to provide adult care, primary care, and community health and unscheduled hospital care. Integration authorities have full power to decide how to use those resources to deliver services, with statutory duties relating to the financial management of each authority assigned to a dedicated chief financial officer. As such, Scottish integration authorities entail a greater degree of vertical integration of the governance, budgetary management and resource allocation for health and social care than is the case for those areas of England involved in integrated care pilots. Some Vanguards focused on integration have introduced joint boards, albeit without statutory responsibilities, and partially pooled budgets, while the Pioneer scheme has focused on horizontal professional and clinical collaborations through physical and virtual service co-location (NHS England, 2016a, 2016b).

Although the benefits of integrated care have long seemed self-evident, there is a need for more systematic evidence on which integration schemes might result in improved outcomes for service recipients, and under what circumstances those schemes might work best. Difference-in-difference studies of the pioneer and vanguard integration pilots indicate that they may have led to reduced emergency hospital admissions among the pilot populations (Keeble et al., 2019, see also Morciano et al., 2020, 2021). A comprehensive evaluation of the vanguard scheme in Salford incorporating Randomized Control Trials found that it enhanced care planning and was popular with patients, even though emergency admissions grew slightly and patient outcomes were largely unaffected (Bower et al., 2018). Subsequent difference-in-difference analysis of the Salford and South Somerset integration vanguards indicate that while they had negligible impact on patient outcomes, the costs of secondary care increased (Stokes et al., 2021). The evidence thus suggests that horizontal integration makes little difference to measurable outcomes. In addition, research on pooled budgets for health and social care in England finds that it does not reduce hospital use or costs (Stokes et al., 2019), albeit for pooling of around 5% of the available monies in each local area.

The existing evidence base on integrated care and outcomes sheds valuable light on whether integration works, but researchers have yet to address the efficacy of vertical integration schemes that fully consolidate the planning, funding and governance of health and social care under the auspices of a single organization. Furthermore, because the existing studies are based on pilot programmes, they are reliant on a comparatively small number of treated areas, which can potentially limit generalisability. Likewise, the opacity of the criteria for selection into the pilot schemes can make it difficult to adequately control for self-selection biases. By comparing the impact of the full vertical integration of health and social care organizations in all local areas across Scotland with comparator areas in England, we therefore hope to contribute evidence on the impact of an understudied integration scheme in a quasi-experimental setting, in which generalisability and selection issues are minimised.

3. Data and methods

The analysis presented here focuses on publicly available measures of health-related outcomes that are published by NHS Scotland, NHS England, and both countries' National Statistical Offices. To compare performance, we draw upon two outcomes attributable to the healthcare system and broadly comparable across Scotland and England: *delayed discharges* and *premature mortality*. These indicators are particularly appropriate for our analysis because they are among the core suite of indicators that integration authorities are legally required to report on to enable the Scottish government to assess their performance (Scottish Government, 2015b).

Delayed discharge rates are a key measure of the success with which patient-centred services and funding for health and social care are being co-ordinated (Godfrey and Townsend, 2009). Indeed, as a recent Scottish government report highlights, "reducing delayed discharge bed days is a key aim for integration authorities" (Butcher, 2019). Premature mortality is regarded as an indicator of health inequalities produced by socio-economic deprivation and is thought to be especially problematic in Scotland (Norman et al., 2011). Hence, the Scottish Government (2015b) has emphasised that a focus on premature mortality is essential because "Scotland has the highest mortality rates in the UK" (p.14). Nevertheless, it should be highlighted that our analysis is restricted to just these two of the measures included in the Scottish government's core suite of indicators due to a lack of comparable longitudinal data on health and social care outcomes across Scotland and England.

Delayed discharges are measured as the annual delayed discharges bed days, averaged per day. Data on delayed discharges for Scotland and England was retrieved from NHS Scotland and NHS England, respectively. Revised data definitions for this indicator and national data requirements were introduced in Scotland from July 1, 2016. The definitional changes are estimated to have resulted in a 4% reduction in bed days from July 2016 onwards, hence we adjusted the prior data accordingly (for technical information on this change see http://www.isdscotland.org/Health-Topics/Health-and-Social-Community-Care/Delayed Discharges/_docs/NSS_Delayed_Discharges_Summary_of_definitional_changes_and_impact.docx, accessed November 18, 2021).

Our second outcome of interest, i.e. premature mortality, is measured as the age standardized death rates of people under 75 years old. Data on premature mortality rates for Scotland and England were retrieved from the National Records of Scotland, and the UK Office for National Statistics, respectively.

We also include in our models a vector of adjustment covariates measured before the introduction of integration authorities to account for pre-treatment area characteristics (The X matrix in Eq. (1)). Specifically, we include a number of local authority level demographic variables taken from the 2011 Scottish and English censuses that might influence health system performance. These adjustment variables are: *population size*, *population density*, the percentage of *population over 65 years old*, *disability status* measured as the percentage of population stating that their day to day activities are limited "a lot", *health status* measured as the percentage of the population who consider themselves

to have "good" or "very good health", and *deprivation*, measured as the percentage of households deprived on one or more of the four dimensions of deprivation used to classify households as deprived; employment, education, health and disability, and housing (for a detailed overview of how this indicator is constructed see https://statistics.ukdataservice.ac.uk/dataset/classification-household-deprivation-great-britain-2011).

It is worth mentioning that by including these adjustment variables in our regressions, we better ensure that we are comparing the health outcomes in Scottish/English local authority areas that have similar observable characteristics, which, therefore would be anticipated to respond in a similar way to the policy implementation (see, e.g., Salinas and Solé-Ollé, 2018). To test the consistency of the results, we estimate our baseline models with and without adjustment covariates.

3.1. Empirical specification

To examine whether the creation of integration authorities in Scotland is related to improvements in outcomes for service recipients, we apply a Difference-in-Differences (DiD) approach. As Scotland implemented a comprehensive vertical integration scheme across the whole country, its introduction provides a sort of 'natural experiment'. To approximate the causal effects of this intervention, Scottish local authority areas can be considered the 'treated group', and local authority areas in other parts of the UK can be considered the 'control group'. To achieve maximum comparability of the treated and control groups, we choose only the North of England for comparison purposes (and not the entire country) because the demographic and socioeconomic characteristics of northern local authorities are more similar to Scotland than the rest of England and Wales. This allows us to estimate more accurately the potential effects of vertical integration. The study sample therefore comprises all 32 local authorities in Scotland, and the 47 unitary authorities and metropolitan districts in the northern regions of England, namely the North East, the North West, and Yorkshire and the Humber (see Appendix A for a full list of local authorities), for the period 2013–2019.

Formally, we estimate the following regression model:

$$Log(y_{it}) = \alpha_0 Treated_i + \alpha_1 Post_t + \alpha_2 (Treated_i * Post_t) + \beta X_i + \varepsilon_{it} \quad (1)$$

where y_{it} represents each of our performance measures, namely delayed discharges, and premature mortality rates, for year t, in local authority area i. $Treated_i$ is a dummy variable coded one for Scottish local authority areas, and zero for the English local authority areas in our control group, and $Post_t$ is a time dummy that switches on for post 2016 observations, i.e., after the date when Scottish Health Boards and Local Authorities were required to be integrated by The Public Bodies (Joint Working) (Scotland) Act 2014. Standard errors used to compute robust 95% confidence intervals are clustered at the local authority level.

The interaction between *Treated* and *Post*, captured by α2, provides the average effect of the Scottish integration of health and social care for each outcome. Nonetheless, if integration authorities in Scotland were not able to immediately adjust their processes and activities right after the integration schemes were implemented, this estimate may provide a downward approximation of the policy effect. To overcome this potential source of bias, we complement our analysis by replacing $Post_t$ with time dummies for each year in our sample, which enables us to estimate dynamic treatment effects. This event study approach (often called the leads and lags model) also permits us to investigate the parallel trends assumption (Autor, 2003). The parallel trends assumption is the key identifying assumption in DiD settings, which implies that in the absence of treatment, the difference between the two groups would have remained stable over time (Angrist and Pischke, 2008). Hence, a deviation from the parallel trend after establishment of the integration authorities can be interpreted as the approximate impact of the policy.

To explore the internal validity of the results, we conduct several robustness checks. First, we use single-group interrupted time series analysis (ITSA) to compare outcomes in Scotland before and after the implementation of integration authorities in Scotland. More specifically, we estimate the following model: Log $(y_{it}) = \alpha_0 + \alpha_1 Time_{it} + \alpha_2 Treatment_{it} + \alpha_3 Time_{it} \times Treatment_{it} + \varepsilon_{it}$, where $Time_{it}$ represents years since the start of the study, and $Treatment_{it}$ is a dummy variable representing the intervention. α_1 represents the baseline trend, that is the trend of the outcome variables before the intervention, α_2 is the level change in the outcomes right after the intervention and α_3 represents the trend change after the intervention. Second, we conduct multiple-group ITSAs for both outcomes to better understand how the outcomes developed over time in Scotland and our control group, the North of England. ITSA estimates are executed using the Stata command XTITSA developed by Linden (2021).

Third, for additional sensitivity analyses, we identified a number of English local authority areas in our control group in which pilot integrated care programs had been run at about the same time that vertical integration took place in Scotland, and removed them from our control group. These programs were the integration-focused Vanguards and the second wave of the Pioneers, which were announced in December 2015 and January 2015, respectively.

Finally, we conduct sensitivity analyses of the DiD models predicting delayed discharges to account for different adjustments to the delayed discharges data. More specifically, we complement our estimates, where the Scottish data was adjusted by 4%, by estimating the DiD model predicting delayed discharges using the raw data (0% reduction), and also increasing the reduction another 4 percentage points (8% reduction).

4. Results

Table 1 reports summary statistics for the number of delayed discharges and premature mortality rates before and after health integration schemes were in place in Scotland. The table shows that the number of delayed discharges were substantially higher in Scotland both before and after the integration of health care and social services. After 2017, however, the average change in delayed discharges diverges for each group; while the number of delayed discharges decreased in Scotland, they increased in the North of England, which might point to a positive effect of the vertical integration of health and social care organizations in Scotland. As regards premature mortality rates, the figures seem to be again higher in Scotland, though these rates decreased slightly at a similar pace after 2017 both in Scotland and the North of England.

Baseline differences between the treated and control groups should not be a concern for our DiD identification strategy, as long as the parallel trends assumption holds. To investigate this, we undertake Mora and Reggio's (2015) parallel trends test for systematic pre-treatment trend differences between both groups, along with the event study approach discussed in the data and methods section. More specifically, we perform the parallel-trend test using the STATA command "*didq*" developed by Mora and Reggio (2015). The command "*didq*" calculates the test with a null of the parallel paths based on auxiliary regressions in which year dummies are interacted with the treatment dummy. Rejection of this test indicates violation of the parallel path assumption. For

Table 1
Descriptive statistics for health outcomes.

	Scotland		North of England	
	Mean	S.D.	Mean	S.D.
Health outcomes 2013-16				
Delayed discharges	45.51	49.48	18.26	14.89
Premature Mortality	420.32	74.53	402.26	56.49
Health outcomes 2017-19				
Delayed discharges	43.99	43.77	23.05	21.16
Premature Mortality	412.78	77.17	393.85	55.49

both outcomes of interest, we cannot reject the null hypothesis of common pre-treatment dynamics (p-values equal to 0.95, and 0.89, respectively).

Table 2 presents the pre-treatment characteristics in Scotland and the North of England. The average characteristics were very similar across the two groups, except in terms of population density, which is clearly higher in the North of England.

The results of our DiD analyses are reported in Table 3. In columns 2 and 3 we present point estimates and robust 95% confidence intervals without including pre-treatment adjustment covariates for both outcomes (model 1), while columns 4 and 5 show the results when including the adjustment covariates (model 2). Robust standard errors used to compute our confidence intervals were clustered by local authority areas to deal with concerns about serial correlation in DiD specifications (see Bertrand et al., 2004). Overall, the results suggest that the implementation of integration authorities in Scotland responsible for planning and resourcing social care, primary, community and unscheduled healthcare resulted in a reduction of delayed hospital discharges, but had no impact on premature mortality rates.

Starting with the impact of vertical organizational integration on delayed discharges, the baseline DiD estimates (model 1) suggest that the policy is associated with a reduction of delayed discharges of about 23.6% (robust 95% CI [−0.442, −0.030]). When we turn to our regression model including adjustment covariates (model 2), the results are almost identical in both magnitude and significance ($\beta = -0.236$; robust 95% CI [−0.443, - 0.029]). This effect size points towards relatively strong benefits of the vertical integration of health and social care organizations in Scotland for one important indicator of patient experience and administrative efficiency. Turning our attention now to the potential impact of vertical integration on premature mortality rates, we find no evidence of either a positive or a negative effect. The point estimates for both models, i.e. with and without adjustment variables, are close to zero ($\beta = 0.002$; robust 95% CI [−0.017, 0.021] for both models). Hence, the creation of integration authorities appears to have made little impact on this key indicator of population health (disparities).

Despite their strengths, the DiD specifications presented in Table 3 provide no information about potential treatment dynamics. To explore whether the impact of introducing integration authorities in Scotland has varied over time, Fig. 1 depicts the pre-treatment patterns along with post-treatment patterns for the event study described above, both excluding and including adjustment covariates (Fig. 1; Panel A, and Fig. 1; Panel B, respectively).

Looking first at the parallel trend assumption, our results suggest that there are no substantial differences between the treatment and control groups before the introduction of Scottish integration authorities in any of the estimated models. The leads and lags models therefore confirm the results of the Mora and Reggio (2015) common trends test reported above. As regards inter-temporal effects, our results suggest that delayed hospital discharges decreased substantially in Scottish integration authorities from year 2017, with the positive effect reaching its peak in 2018, where the estimated impact of the program is about a 36% reduction in delays. Our estimates also suggest, however, that this achievement was diminished somewhat in 2019, where the magnitude of the confidence intervals prevent us from concluding that the previous improvements in patient experience and administrative efficiency continued during this year. Looking now at the impact of vertical integration on premature mortality rates, the event study results mirror our baseline DiD estimates; that is, we do not find evidence that the creation of integration authorities in Scotland had an effect on premature mortality, with all estimated coefficients being close to zero.

Table 2
Descriptive statistics for adjustment covariates.

	Scotland		North of England	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Population	165.48	127.91	269.43	133.77
Population density	4.76	7.53	15.36	10.35
Population over 65	17.82	2.26	16.53	2.20
Disability	9.30	1.73	10.32	1.68
Health status	82.64	2.62	78.67	2.21
Deprivation	59.50	4.34	60.43	4.57

Notes: population figures measured in thousands; population density is the number of persons per hectare; population over 65 years old, disability status, health status, and deprivation are reported in percentage points.

Table 3
Difference-in-differences estimates of the effects of vertical integration.

	Model I		Model II	
	Delayed Discharges	Premature Mortality	Delayed Discharges	Premature Mortality
Treated	0.682*** (0.278, 1.086)	0.038 (-0.031, 0.108)	1.448*** (0.586, 2.310)	0.212*** (0.166, 0.258)
Post	0.214*** (0.078, 0.351)	−0.021*** (-0.030, −0.012)	0.214*** (0.077, 0.352)	−0.021*** (-0.030, −0.012)
Treated × Post	−0.236** (-0.442, −0.030)	0.002 (-0.017, 0.021)	−0.236** (-0.443, −0.029)	0.002 (-0.017, 0.021)
Population			0.004*** (0.003, 0.005)	0.000 (-0.000, 0.000)
Population Density			0.017** (0.003, 0.031)	0.004*** (0.003, 0.005)
Population over 65			0.019 (-0.049, 0.087)	−0.021*** (-0.027, −0.014)
Disability			−0.136 (-0.401, 0.128)	−0.002 (-0.018, 0.015)
Health status			−0.08 (-0.351, 0.191)	−0.025*** (-0.037, −0.014)
Deprivation			−0.021 (-0.102, 0.059)	0.012*** (0.006, 0.018)
Observations	553	553	553	553
R-squared	0.104	0.019	0.557	0.816

Notes: Robust 95% Confidence Intervals in parentheses. ***p < 0.01, **p < 0.05.

4.1. Robustness tests

The ITSA results for both outcomes, reported in Appendix B, Table B1, point in the same direction as the DiD estimates, with vertical integration in Scotland resulting in a reduction of about 14% in terms of delayed discharges, while we cannot conclude that integration had an effect on premature mortality. Fig. B1 in Appendix B provides a visual display of the multiple-group ITSA results, which again point in the same direction as our baseline DiD estimates. Importantly, it should be highlighted that, although there seem to be differences in the initial mean levels between the treated group and control group, as shown in Fig. B1, the groups were balanced on pre-intervention trends for both outcomes, thus confirming the parallel trends' tests results reported previously. Ideally, for a multiple-group ITSA approach the control group will be the same as the intervention group both in pre-intervention levels and trend. However, in our DiD approach the absolute differences between the policy group and the control group are not as important as in ITSA approaches, since the subject of analysis is the differences in the changes over time, mostly relying on the pre-intervention parallel trends assumption.

To investigate whether inclusion of integration pilot areas in England might in some way influence our results, we first removed local

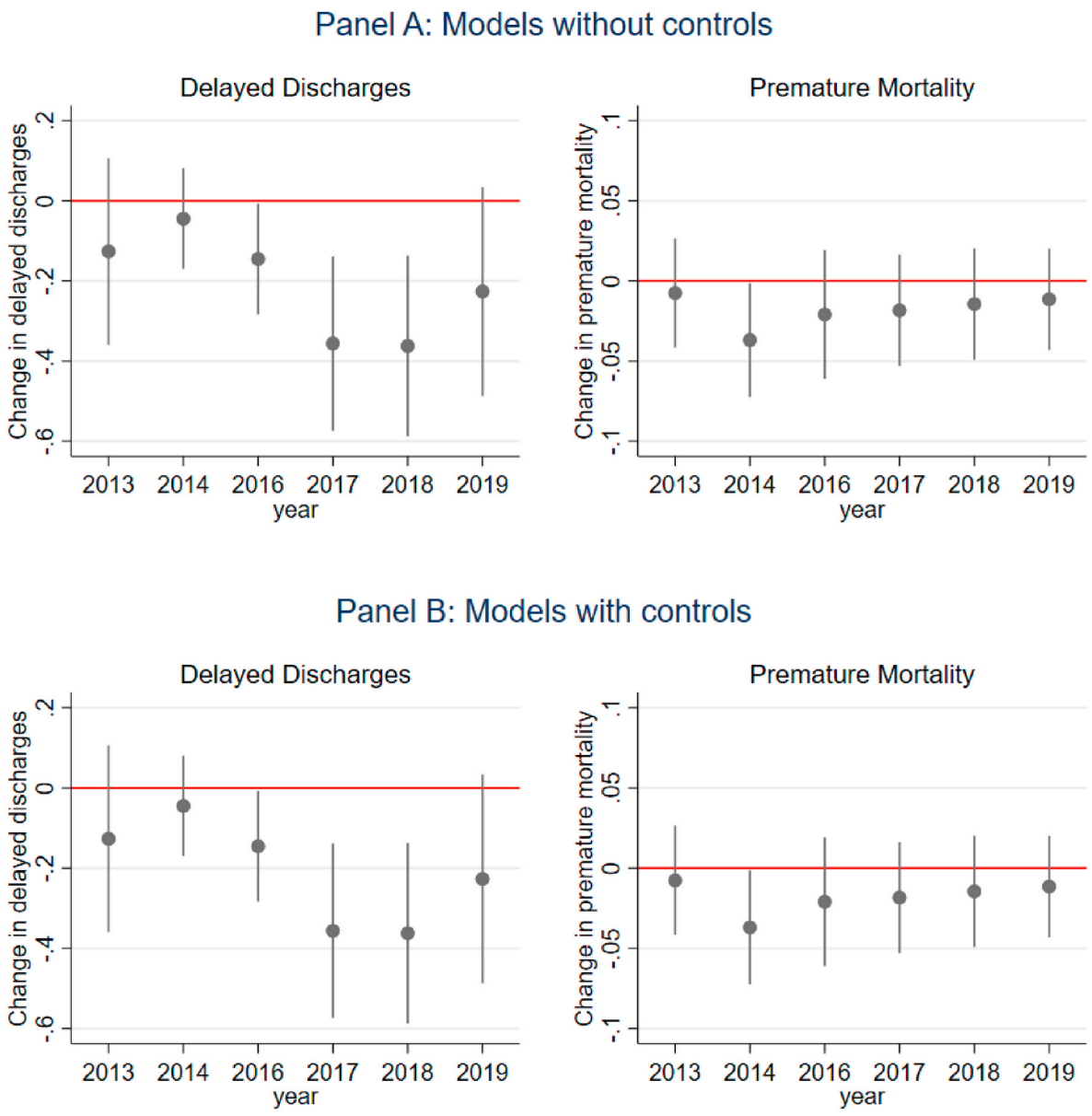

Fig. 1. Leads and lags model of effect of vertical health and social care integration on delayed discharges and premature mortality. This figure shows the coefficients and 95 percent confidence intervals from event study regressions that estimate interactions between year and treated status. Black dots represent point estimates and vertical bars show robust 95% CIs. Year 2015 is the omitted category.

authority areas that were integration Vanguards as they involved the most comparable reforms to that implemented in Scotland. In particular, those Vanguards aimed at integrating primary care, social care and acute healthcare organizations through the introduction of joint boards composed of CCG and local authority members, with some pooled budgeting (NHS England, 2016b) - in our sample, Northumberland, Salford, and Wirral. The results of our baseline DiD models when excluding these areas are reported in Appendix B, Table B2. The results for both outcomes remain virtually unchanged.

We then remove from the control group, those English local authority areas in which the second wave of the Pioneers program ran, encompassing an array of integration initiatives largely aimed at encouraging horizontal collaboration amongst different groups of health and social care professionals through physical or virtual co-location (NHS England, 2016a). These local authorities are Bolton, Bury, Manchester, Oldham, Rochdale, Tameside, Trafford, Salford, Stockport, Wigan, and York. The results of our baseline DiD models excluding both the integration Vanguards and the Pioneers are reported in Appendix B, Table B3. Again, the results point in the same direction, though the standard errors are larger on this occasion, probably due to the substantial reduction in sample size (approximately 28%). For comparability, in Appendix B, Fig. B2, displays the results of conducting a multiple-group ITSA as discussed above, excluding Vanguards and Pioneers from our control group. The actual and predicted values for both outcomes under scrutiny are very similar to those reported in Fig. B1, with all the Northern English local authorities included in the control group.

Finally, the results for our tests with adjusting delayed discharges data, reported in Appendix B, Table B4, are in line with our previous estimates, suggesting a reduction of delayed discharges of about 27% and 20%, respectively.

5. Concluding discussion

The findings presented above contribute to the burgeoning literature on health and social integration by providing statistical evidence of the impact of a vertical organizational integration scheme on outcomes that matter to patients, policy-makers and practitioners. The findings highlight that the introduction of integration authorities in Scotland appeared to result in substantial improvements in rates of delayed discharges – an important indicator of administrative efficiency and patient experience, with our estimates suggesting a decrease of delayed discharges ranging from 14% to 27%, depending on the model specification Although improvements in premature mortality rates were not observed in the wake of the vertical integration of Scottish primary, social, community and unscheduled hospital care, such indicators of population health are widely recognised to be less tractable to discrete policy initiatives and interventions (Mansfield et al., 1999; Thomas et al., 2010). Importantly, the findings imply that despite the on-going challenge of bringing together health and social care professionals (Pearson and Watson, 2018), some of the performance dysfunctions associated with large-scale restructuring of healthcare delivery systems may not have emerged on this occasion. The findings from our study therefore have important implications for the reform of healthcare systems.

5.1. Strengths and weaknesses of the study

Although a growing literature suggests that health and social care integration is necessary for improving outcomes for service recipients (e.g. Glasby and Dickinson, 2014), comparatively little research has addressed the effectiveness of the vertical integration of health and social care organizations as a vehicle for doing so (see Baxter et al., 2018; Lijas et al. 2019). This study advances research on this topic of international significance by systematically analysing outcomes in the wake of the introduction of a large-scale vertical integration scheme. By adopting a DiD-style analysis we deploy a rigorous methodology for approximating causal relationships between organizational integration and outcomes. Our findings point to the potential value of the vertical integration of health and social care organizations for achieving improvements on measures of administrative efficiency and patient experience.

Importantly, the findings that we present are robust to several additional checks, including interrupted time-series analysis, alternative approaches to comparing delayed discharge rates in England and Scotland, and exclusion of English local areas that piloted integration schemes from the control group. However, the nature of the care population remains substantially different between the two countries, with a vastly greater proportion of adults that need care receiving it directly from the state in Scotland than in England (https://www.nuffieldtrust.org.uk/comment-series/adult-social-care-in-the-four-countries-of-the-uk). Hence, while parallel trends tests indicate that the different pre-reform trajectories of both the outcomes that we analyze were constant over time, levels of delayed discharges were considerably higher in Scotland than in England before and after the creation of integration authorities. This variation may reflect the differing funding eligibility in the two countries and highlights the difficulty of developing comparable control groups for studies of integrated care - something that is particularly challenging when many local areas are introducing integration schemes of one kind or another.

5.2. Implications for policy

While most developed countries have stopped short of the full integration of health and social care organizations (Robertson, 2011), our analysis indicates that vertical integration can potentially have a substantial positive effect on administrative efficiency and patient experience. Although population health improvements were not observed, the results from our study imply that fully integrated decision-making, accountability and funding structures may be essential for ensuring that integration fulfils its promise as a vehicle for achieving the "triple aim". Policy-makers concerned with achieving system-wide improvement should therefore consider the potential costs and benefits of moving from separate institutional structures for the oversight of primary, social and unscheduled hospital care to a single unified structure with a statutory foundation. In doing so, the literature on achieving change in healthcare systems highlights that they should pay close attention to initiatives that can motivate key stakeholders to work closely together and to processes and practices that can overcome the potential challenges associated with garnering commitment to new structures (Ling et al., 2012; Sims et al., 2021).

The research also provides valuable lessons for professionals working within the field of integrated care. While integrated working on the front-line may be difficult to achieve (Cameron et al., 2014), when funding structures and lines of accountability are fully integrated at the local level it appears to a valuable source of capacity for driving healthcare improvement. Time and resources spent networking with colleagues in cognate areas and building partnerships between local service providers may therefore help to reap further dividends from improved strategic co-ordination in a vertically integrated system (Sims et al., 2021). Likewise, although the vertical integration of health and social care organizations appears to make little difference to long-term population health inequalities, as evidenced by premature mortality rates, it may nevertheless play a crucial role in garnering broader support for local co-ordinated action to address those inequalities. More

specifically, the institutional clout, reputation and purchasing power of a well-integrated system can potentially ensure that it has a stronger voice in national policy-making debates. Vertical integration of health and social care organizations may therefore represent an effective means for securing the long-term viability of a healthcare system.

5.3. Unanswered questions and further research

Despite the strengths of our study, we are not able to pinpoint the precise mechanisms through which the positive effects of vertical integration emerge. In-depth case studies of the planning, resourcing and governance of integrated care in Scotland and England could be carried out to identify which features of vertical integration seem to be most likely to enhance (or detract from) administrative efficiency and patient experience. Research comparing levels of capacity in the community and social care sectors in Scottish integration authorities versus that present in the English healthcare system, would cast valuable light on the optimal forms of integration for the promotion of patient-led services and care pathways. Comparative data on the quality of service user, carer and community participation in the decision-making processes within each system would also be informative. Likewise, analyses of the impact of vertical integration on a wider range of outcome measures, such as emergency admissions and readmissions – indicators that are currently not comparable across the systems in Scotland and England – would be useful.

In addition to more detailed comparisons of the distinctive organizational dynamics within the Scottish and English systems, researchers could devote greater attention to understanding patients' experiences of care pathways in fully and partially integrated systems. Prior research on stakeholders' views about integrated care suggests that a focus on hospital-based outcomes, such as delayed discharges, can detract from a deeper appreciation of how well the system is performing overall (Crocker et al., 2020). Although a recent large-scale survey across eight European countries highlights that patients, caregivers, professionals and policy-makers all greatly valued continuity of care (Rutten-van Mölken et al., 2020), there is a need for better comparative indicators of quality of care, patient satisfaction and system demand. Furthermore, on this occasion, we were unable to address the impact of vertical integration on costs due to the different institutional arrangements for allocating and managing primary care expenditures in Scotland and England. To fully understand the strengths and weaknesses of the alternative integration schemes present in different systems, it will be necessary for researchers to devise methods for accurately comparing healthcare accounting practices, organizational roles and responsibilities, and patient outcomes.

6. Conclusion

This study highlights how the full integration of planning and resourcing for adult social care, primary care, community health and unscheduled hospital care seems likely to result in better organizational efficiency and patient experience. For health policy-makers, the main implication of the study findings is that serious attention should be given to designing and implementing fully-integrated governance structures for health and social care organizations. Further research focused on understanding how to make integrated structures work would therefore do much to support improvements in public healthcare.

Credit author statement

José M. Alonso: Methodology, Investigation, Writing – original draft, Writing- Reviewing and Editing. Rhys Andrews: Conceptualization, Writing – original draft, Writing- Reviewing and Editing.

Data availability

Data will be made available on request.

Appendix A. Local authorities included in the control group

The control group comprises the 47 unitary authorities and metropolitan districts extant across the northern regions of England, namely the North East, North West, and Yorkshire and the Humber:

Barnsley	Northumberland
Blackburn With Darwen	Oldham
Blackpool	Redcar & Cleveland
Bolton	Rochdale
Bradford	Rotherham
Bury	Salford
Calderdale	Sefton
Cheshire East	Sheffield
Cheshire West And Chester	South Tyneside
Darlington	St Helens
Doncaster	Stockport
Durham	Stockton On Tees
East Riding of Yorkshire	Sunderland
Gateshead	Tameside
Halton	Trafford
Hartlepool	Wakefield
Kingston Upon Hull	Warrington
Kirklees	Wigan
Knowsley	Wirral
Leeds	York
Liverpool	
Manchester	
Middlesbrough	
Newcastle Upon Tyne	
North East Lincolnshire	
North Lincolnshire	
North Tyneside	

Appendix B. Sensitivity analyses

Table B1
Parameter estimates single-group interrupted time series analysis.

	Delayed discharges	Premature mortality
Baseline trend	0.059	0.003
	(-0.002, 0.119)	(-0.008, 0.014)
Level change after integration schemes	−0.141**	−0.026
	(-0.264, - 0.019)	(-0.061, 0.009)
Trend change after integration schemes	−0.086	−0.005
	(-0.188, 0.016)	(-0.023, 0.014)
Observations	224	224

Notes: Robust 95% Confidence Intervals in parentheses. ***p < 0.01, **p < 0.05.

Table B2
Difference-in-differences estimates excluding English local authority areas participating in the Vanguards program.

	Model I		Model II	
	Delayed Discharges	Premature Mortality	Delayed Discharges	Premature Mortality
Treated	0.656***	0.038	1.423***	0.214***
	(0.246, 1.065)	(-0.033, 0.109)	(0.534, 2.313)	(0.167, 0.262)
Post	0.199***	−0.020***	0.199***	−0.020***
	(0.061, 0.336)	(-0.030, −0.010)	(0.060, 0.337)	(-0.030, −0.010)
Treated × Post	−0.220**	0.000	−0.220**	0.000
	(-0.427, −0.013)	(-0.019, 0.020)	(-0.428, −0.012)	(-0.019, 0.020)
Population			0.004***	−0.000
			(0.003, 0.005)	(-0.000, 0.000)
Population Density			0.017**	0.004***
			(0.003, 0.031)	(0.002, 0.005)
Population over 65			0.028	−0.021***
			(-0.040, 0.096)	(-0.028, −0.015)
Disability			−0.123	−0.003
			(-0.405, 0.159)	(-0.021, 0.016)
Health status			−0.081	−0.026***
			(-0.365, 0.204)	(-0.038, −0.014)
Deprivation			−0.027	0.012***
			(-0.108, 0.055)	(0.006, 0.018)
Observations	532	532	532	532
R-squared	0.095	0.018	0.565	0.812

Notes: Robust 95% Confidence Intervals in parentheses. ***p < 0.01, **p < 0.05.

Table B3
Difference-in-differences estimates excluding English local authority areas participating in the Vanguards and/or second wave of Pioneers programs.

	Model I		Model II	
	Delayed Discharges	Premature Mortality	Delayed Discharges	Premature Mortality
Treated	0.691***	0.034	1.427***	0.214***
	(0.256, 1.125)	(-0.039, 0.107)	(0.526, 2.327)	(0.167, 0.260)
Post	0.135	−0.020***	0.135	−0.020***
	(-0.027, 0.297)	(-0.031, −0.008)	(-0.028, 0.298)	(-0.031, −0.008)
Treated × Post	−0.156	−0.000	−0.156	−0.000
	(-0.380, 0.067)	(-0.020, 0.020)	(-0.382, 0.069)	(-0.020, 0.020)
Population			0.005***	−0.000
			(0.003, 0.006)	(-0.000, 0.000)
Population Density			0.013	0.004***
			(-0.003, 0.029)	(0.003, 0.006)
Population over 65			0.032	−0.021***
			(-0.040, 0.103)	(-0.028, −0.014)
Disability			−0.122	−0.001
			(-0.414, 0.170)	(-0.021, 0.019)
Health status			−0.079	−0.025***
			(-0.369, 0.211)	(-0.039, −0.012)
Deprivation			−0.012	0.011***
			(-0.100, 0.076)	(0.004, 0.018)
Observations	462	462	462	462
R-squared	0.107	0.015	0.581	0.798

Notes: Robust 95% Confidence Intervals in parentheses. ***p < 0.01.

Table B4
Difference in differences estimates for delayed discharges; sensitivity analyses using alternative adjustments of the Scottish data,

	No adjustment		8% adjustment	
Treated	0.721***	1.494***	0.642***	1.402***
	(0.315, 1.126)	(0.627, 2.362)	(0.239, 1.044)	(0.547, 2.257)
Post	0.214***	0.214***	0.214***	0.214***
	(0.078, 0.351)	(0.077, 0.352)	(0.078, 0.351)	(0.077, 0.352)
Treated × Post	−0.270**	−0.270**	−0.198*	−0.198*
	(-0.473, −0.066)	(-0.474, −0.065)	(-0.403, 0.007)	(-0.404, 0.008)
Population		0.004***		0.004***
		(0.003, 0.005)		(0.003, 0.005)
Population Density		0.017**		0.017**
		(0.003, 0.032)		(0.003, 0.031)
Population over 65		0.019		0.018
		(-0.049, 0.087)		(-0.049, 0.086)
Disability		−0.138		−0.135
		(-0.405, 0.128)		(-0.398, 0.128)
Health status		−0.082		−0.078
		(-0.356, 0.191)		(-0.347, 0.190)
Deprivation		−0.022		−0.021
		(-0.102, 0.059)		(-0.101, 0.059)
Observations	553	553	553	553
R-squared	0.111	0.561	0.097	0.555

Notes: Robust 95% Confidence Intervals in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

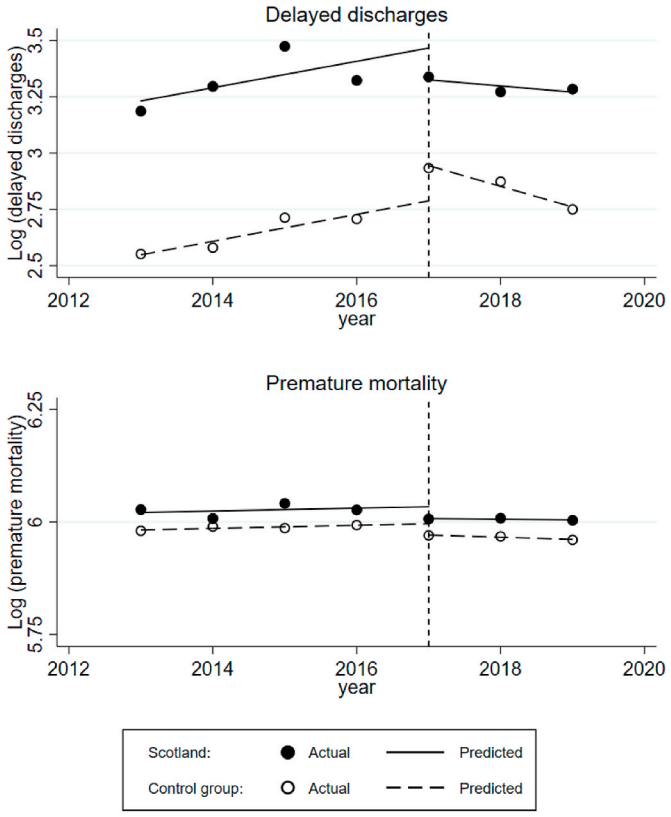

Fig. B1. Multiple-group Interrupted Time Series Analysis

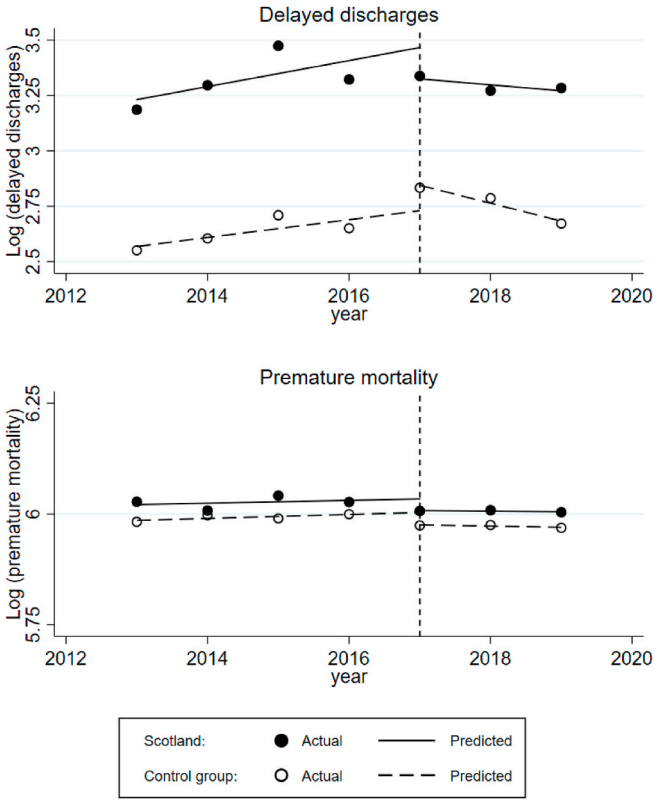

Fig. B2. Multiple-group Interrupted Time Series Analysis excluding English local authority areas participating in the Vanguards and/or second wave of Pioneers programs.

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