Improvement Analytics Unit
November 2020

Technical report: The impact of Extensive Care Service and Enhanced Primary Care in Fylde Coast

Findings from the Improvement Analytics Unit

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The Health Foundation

Key points

- The IAU has evaluated the Fylde Coast multispecialty community provider (MCP), jointly led by Blackpool and Fylde & Wyre clinical commissioning groups (CCGs). The Fylde Coast NHS vanguard launched two complementary integrated care teams (ICTs), the Extensive Care Service (ECS) in 2015 and Enhanced Primary Care (EPC) in 2016. Both use risk stratification to identify adults with complex chronic care needs.
- ECS focuses on serving older people with more comorbidities, requires patients to de-register with their GP and subsequently replaces usual GP care with a coordinated and specialist multidisciplinary team. EPC supports an individual's existing GP relationship, where they have been identified as potentially benefiting from wrap-around multidisciplinary care such as health coaching. The two services were designed to be complementary, serving somewhat different patient populations and with EPC serving as a 'step-down' bridge between ECS and routine primary and community care.
- The IAU identified intervention patients who were enrolled on ECS (n=1,626) and EPC (n=3,011). We followed ECS and EPC patients from enrolment for up to 33 and 18 months respectively. The evaluation looks at the early impact of the new models of care up to April 2018, after which the interventions changed. An ongoing IAU study looks at the long-term impact of integrated care in the Fylde Coast area.
- ECS and EPC were evaluated separately and for each evaluation we selected a matched control group that included similar individuals in the local area who had not been referred for the service. We then compared the hospital use of interventions and control patients, after risk adjusting for age, prior admissions, health conditions and other variables previously identified as predictive of hospital use.
- We found that ECS patients were admitted to hospital in an emergency 27% (95% confidence interval: 15% to 41%) more often compared with their matched control. We found similar trends across other measures of hospitalisation. Increased use was observed among ECS for A&E attendances, chronic ambulatory care sensitive admissions and urgent care sensitive admissions compared with a matched control.
- For EPC patients we found increases in hospital use on the same metrics: for example, emergency admissions were 42% (95% confidence interval: 29% to 56%) higher for EPC patients compared with their matched controls.
- The study has some limitations, most notably that even after using robust statistical methods, there were remaining observable differences between intervention and matched control groups. Matched control individuals were slightly but notably less ill than the intervention patients. In the case of EPC (but not ECS) we also found that the death rate was higher in the intervention group than in matched controls, which strongly suggests greater baseline risk in this group prior to receiving EPC that could not be accounted for in the accessible data. This may explain their greater hospital use.
- In the absence of a randomised controlled trial, we cannot be sure whether the higher rates of hospital use could be explained by unobserved differences in the characteristics of ECS, EPC and the respective matched control groups. However, it appears unlikely that unobserved differences could explain all of the much higher hospital activity among ECS and EPC patients. Furthermore, it is very unlikely that any such differences could hide a decrease in hospital use. We interpret the findings to show that neither model of care reduced hospital activity during the respective follow-up periods but cannot conclude that the observed higher levels of activity are a direct causal effect of ECS or EPC. Other evaluations of similar models of care have reached similar conclusions.
- The findings are consistent with previous studies and experience of ICTs in the UK and in other developed health care settings. Implementation of such services may require a longer time period to reduce population-wide admissions and attendances, as unmet medical need is initially identified and treated among high risk patients by MDT professionals. A recent IAU study into an integrated care transformation programme showed it may take 5–6 years to see reductions in hospital use.

The Improvement Analytics Unit

The Improvement Analytics Unit is an innovative partnership between NHS England and NHS Improvement and the Health Foundation that provides robust analysis to help health services improve care for patients. We use advanced statistical techniques to provide evidence of whether local change programmes are having an impact on improving the quality and efficiency of care. This is done by assessing whether the care outcomes for patients in a local change programme – for example, as part of a new care model or a sustainability and transformation partnership – are different in any significant way from the outcomes of patients who have not experienced a similar initiative.

Our aim is that our analysis helps NHS providers, their partners and commissioners to identify whether change has happened following implementation of a new initiative, in order to identify whether the initiative is working well or needs to change to succeed.

For more information see: www.health.org.uk/IAU

Background and summary of local interventions

In March 2015, the Fylde Coast area was one of the first multispecialty community provider (MCP) 'vanguard' sites selected from across England as part of the NHS England new care models programme. Known collectively as the Fylde Coast NHS vanguard, health and care organisations from across the region committed to working together to improve the health of people in the region.

The Fylde Coast is the collective name for Blackpool and the boroughs of Fylde and Wyre. Health services are coordinated for the area by two clinical commissioning groups (CCGs): NHS Blackpool CCG and NHS Fylde & Wyre CCG.

Blackpool has six neighbourhoods with 21 GP practices comprising the NHS Blackpool CCG and serving around 172,000 registered individuals. The borough of Fylde is split into two neighbourhoods, as is the borough of Wyre. The Fylde and Wyre boroughs cover an area 10 times larger than Blackpool but have a smaller registered population of approximately 155,000 between them, who are served by 19 GP practices belonging to NHS Fylde & Wyre CCG.

The Fylde Coast population is diverse. The city area of Blackpool experiences significant levels of deprivation, health inequalities, and low life expectancy that rank among the worst in the country. The suburban and rural towns and villages of Fylde & Wyre have a similar socio-economic profile to English national averages but have a growing proportion of older people and increasing numbers of people living with multiple long-term conditions.[1,2]

Your Care, Our Priority Fylde Coast vanguard

Vanguard funding allowed the Fylde Coast vanguard to implement three new models of care: Extensive Care Service (ECS), Enhanced Primary Care (EPC), and Episodic Care. These were implemented under the banner Your Care, Our Priority, and collectively aimed to build a proactive, systematic care-planning approach that supports people in Fylde Coast to better manage their conditions within the community and thus to reduce pressure on hospitals, GP practices, and emergency care. Each model was aimed at a different population cohort, with care tailored to the risk profile of each cohort using a population health management approach. For more information about these models, their aims, deliverables and outcomes, please refer to the statistical analysis protocol (SAP) for this study.[3]

This report presents the findings from the Improvement Analytics Unit's evaluation of the ECS and EPC programmes that were implemented as part of the Your Care, Our Priority vanguard. Episodic Care was not part of this evaluation, as more priority was given to EPC and ECS programmes. Subsequent IAU studies will look to bring together evidence around the impact of integrated care programmes, including EPC and ECS, on hospital outcomes.

Extensive Care Service (ECS)

ECS is based upon the CareMore model,[4] an integrated health plan and care delivery system for Medicare and Medicaid patients in the United States. Under the ECS model, care is delivered by a dedicated health care team led by a consultant extensivist (a medical doctor specialised in the care of older people). The team work together to provide proactive and coordinated care centred to the patient, and temporarily replace the patient's usual GP for their primary care needs. In addition to the multidisciplinary team, ECS initially offered more frequent visits or longer consultations compared to regular care. Teams were anchored in neighbourhoods to help patients to manage their health within the community. When we spoke to them, ECS managers and staff noted that a vital ingredient of the service was the team 'huddle' which occurred soon after patients were referred and enabled them to meet to holistically plan each patient's care. Individual care plans were updated in weekly team huddles as needed, and this process helped the teams to coordinate the management of complex and overlapping long-term health needs such as diabetes and cardiovascular disease.

The ECS model was introduced in June 2015 for the highest risk patients, defined as those aged 60 years or over with two or more specific long-term conditions (LTCs) – coronary artery disease, atrial fibrillation, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), diabetes or dementia – and a predicted risk score of hospital admission within the next 12 months greater than or equal to 20 according to the Combined Predictive Model.[5] In response to clinician feedback and lower than expected patient recruitment, the eligibility criteria were relaxed in February 2016[6] and clinicians had the option to refer patients even if they did not fully meet these eligibility criteria.

Originally, only GPs could refer patients to ECS. However, the referral pathway was later broadened so that secondary and community care providers could also refer. Once patients were referred to their local ECS hub, the hub-based team took over full clinical responsibility for them and had clear accountability for providing and coordinating the patients' primary care on behalf of the NHS.

Enhanced Primary Care (EPC)

The EPC model was aimed at individuals aged 16 years or over who could benefit from increased support because of a long-term condition (LTC) or other factors. EPC patients were normally referred by their GP but were also sometimes referred by other health care professionals such as district nurses, and they could self-refer. EPC was not available to patients who were actively being managed under the ECS service but could serve as a step-down or step-up service between ECS and standard episodic care. EPC was designed to care for a healthier and younger patient group than ECS, with particular attention given to people affected by mental ill health and/or difficult social circumstances. Under the EPC model, a local community-based neighbourhood care team worked with GPs and other practice staff to provide wrap-around support for eligible patients. Facilitated by shared electronic records and a single point of contact for all out-of-hospital services, the team offered support and advice to patients on how to monitor their health conditions and how to access social services, to enable them to self-care and better manage their own conditions, thus reducing preventable visits to their GP or hospital. By February 2017,

eight EPC teams were fully mobilised across Fylde Coast. Like the ECS hubs, the EPC teams were based in neighbourhoods, which increased the ability of the vanguard to deliver an integrated care package that built upon existing local health care, social care and voluntary services and made use of the estate assets available. Because services were situated so that they were geographically close to patients, it may have been easier to tackle problems related to social isolation, loneliness and poor mental health.

EPC was open to any adult who was identified by a primary care provider as someone who would benefit from enhanced support beyond routine primary care. Referrals to EPC were triaged, so that new patients had an initial appointment with the clinician best able to support them. Subsequent visits sometimes involved other members of the multidisciplinary team.

Other interventions in the Fylde Coast

In addition to the ECS and EPC new models of care which formed Your Care, Our Priority, NHS Fylde & Wyre CCG and NHS Blackpool CCG implemented various campaigns and initiatives for the entire community, including people enrolled on ECS and EPC. Episodic Care included planned and spontaneous initiatives that were intended to make incremental improvements to care for the general population, for instance signposting individuals to pharmacists for primary care advice and the Blackpool High Intensity User programme that aimed to address frequent 999 callers.[7]

Our analysis assesses the effect of ECS and EPC over and above regular care (including initiatives such as Episodic Care) that were available to all individuals who were registered with a GP practice in the Fylde Coast region. Additionally, the bulk of the Fylde Coast's vanguard investment was directed toward ECS and EPC.

Further special interventions that were not available to the whole community, and which we accounted for in our analyses, include Enhanced Health in Care Homes[8] and the Lancashire and Cumbria Innovation Alliance Test Bed.[9]

About this evaluation and analysis

This evaluation was conducted after the end of the first phase of vanguard implementation. It aimed to provide insights that, when combined with other local evidence, would inform the development and continuous improvement of vanguard services and encourage discussion regarding potential changes that could be made to the care models. The two care models (ECS and EPC) were analysed separately as they were designed to serve largely distinct populations, but the two analyses followed very similar statistical procedures. Results are presented separately for each care model, though in the final section of this report we discuss what the combined set of results might mean for Fylde Coast stakeholders and the wider NHS.

Preliminary findings from the evaluation were first discussed with Blackpool CCG and Fylde & Wyre CCG in March 2019, and the final results shared in September 2019. The analysis was conducted according to a statistical analysis protocol (SAP), which was subject to independent academic peer review.[3] The SAP was developed with Blackpool CCG and Fylde & Wyre CCG and agreed with them before analysis began.

Data used in the analysis

We used various data sources for this analysis. The Fylde Coast NHS vanguard provided the IAU with a pseudonymised* list of patients referred to EPC and ECS and the dates they were accepted into ECS or EPC. The vanguard also provided Combined Predictive Model risk scores, which are an estimate of the likelihood of a patient being admitted to hospital in the next 12 months, and data for LTCs† for all patients in the Fylde Coast area. More detail on the risk scores and data linkage procedures is included in Table 3 in the SAP. The National Commissioning Data Repository (NCDR) provided the IAU with data based on pseudonymised monthly extracts of the National Health Applications and Infrastructure Services (NHAIS) database. These extracts listed people who had been registered with a GP in the Fylde Coast area at any point during the study period, including their pseudonymised NHS number and the month and year of their birth and death (if applicable). These data allowed us to estimate the dates when patients initially registered with a general practice in the Fylde Coast area, and when they left their practice or died.

The NCDR also supplied us with pseudonymised national hospital administrative data from the Secondary Uses Services (SUS). We used these data to determine patients' health conditions and their levels of hospital use.

At various points in the study, we linked the three data sources together, for example to calculate when people received the new models of care, to calculate baseline risk and select appropriate matched controls, and to tabulate hospital activity. The data linkage was performed using pseudonymised NHS patient identifiers and at no point did the IAU have access to identifiable data. Throughout, the minimum amount of data was used.

Identifying patients

The evaluations of ECS and EPC included patients who were accepted onto the relevant care model and were:

- registered with a Fylde Coast GP for at least 1 month; and
- admitted to hospital at least once in the 3 years before the start of the study (as information on prior health conditions was needed to select a control group).

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* Pseudonymised data sets were stripped of identifiable fields, such as name, full date of birth and address. A unique person identifier (such as an NHS number) was replaced with a random identifier. For this analysis, this identifier was used to link data sources and hospital records for the same person over time.

† For full detail on LTCs and hospital activity see figures and the SAP here: https://www.health.org.uk/sites/default/files/2020 01/fylde_coast_nhs_vanguard_statistical_analysis_protocol.pdf . We use Elixhauser and Charlson index indicators of frailty, as well as those in the IPOPAEGP (inpatient, outpatient, A&E and GP) database. One LTC flag, for HIV-positive diagnosis, was suppressed and was not used for any patient in this study, in line with national data privacy regulations governing the use of routine NHS data.

Individuals were excluded from the evaluation if they were enrolled on ECS or EPC for fewer than 28 days. Individuals who used both ECS and EPC during the period covered by the evaluation were included in the evaluation of ECS but excluded from the EPC evaluation. This approach avoided double counting individuals. For these patients, we attributed any impact of EPC to ECS, which was the more intensive service.[10]

Our evaluation of ECS covered the period from mid-August 2015 (1 month after it accepted its first patient in July 2015) to mid-April 2018. The evaluation of EPC covered the period from November 2016 (again, 1 month after the first patient) to mid-April 2018. The evaluation therefore covered 33 months for ECS and 18 months for EPC. We excluded the first month for each service to allow for a limited 'bedding-in' period.

Following referral, patient consent, and clinical assessment, 1,723 patients were accepted onto ECS, 1,626 of which (94.4%) met the inclusion criteria for our evaluation and comprised our ECS intervention group. The other 97 patients (5.6%) were excluded for reasons related to the validity and quality of the data, in accordance with the criteria that were pre-specified in the SAP.[3] These individuals were enrolled on the ECS service only outside of the evaluation period, died before the evaluation start date, were missing baseline socio-demographic risk data, and/or did not have any hospital admission recorded for the 3 years prior to the start of the evaluation.

18,548 individuals were referred to EPC during the evaluation period, but only a minority of these patients (6,759, or 36.4%) accepted the referral and started to use the service. There were several reasons why patients who were referred to EPC did not begin to use the service, including patient preferences and limited service capacity; sometimes health care teams also revised their views about whether patients were suitable for the service after they had conducted a more detailed clinical assessment. Of patients who started to use EPC, 3,011 (44.5%) met our evaluation inclusion criteria as detailed in the SAP.[3] Some individuals had to be excluded because their records could not be linked between local enrolment and hospital data, and some records had data quality issues such as an indeterminate or invalid EPC start date. We removed 261 EPC patients (3.9%) who also used ECS and were included in the ECS evaluation. We also excluded 218 people whose enrolment date fell outside the specified period.

In total, 1,626 ECS patients and 3,011 EPC patients were included. They constituted the intervention groups for the respective analyses.

Selecting the matched control groups

The goal of selecting matched controls, rather than comparing ECS or EPC patients with the general population, is to allow a like-for-like comparison. It would be misleading to compare the outcomes of ECS and EPC users with those of younger, healthier people who were never eligible for either service. Analysis was carried out separately for ECS and EPC, using very similar statistical procedures. We first identified a pool of potential controls from the Fylde Coast area who were not part of either the ECS or EPC intervention groups. This process identified 77,536 potential control records for ECS and 113,771 for EPC.*

* See the SAP for further details here: https://www.health.org.uk/sites/default/files/2020-01/fylde_coast_nhs_vanguard_statistical_analysis_protocol.pdf

We then removed people who were very different to the ECS and EPC patients based on age, gender, Combined Predictive Model risk scores and hospital activity prior to enrolment. Next, we implemented a matching algorithm separately for each of the 10 Fylde Coast vanguard neighbourhoods and for ECS and EPC.

We used a matching algorithm that has been widely used and validated in similar studies in medical statistics and social policy.[11,12] It generated matched control groups that were similar to the ECS and EPC patients with respect to variables that have previously been demonstrated to affect hospital use and outcomes, including patient age, existing health conditions (including history of mental ill health), Combined Predictive Model risk score[5], approximate local area socio-economic deprivation as measured by the Index of Multiple Deprivation (2015), and history of hospital use before referral to ECS or EPC.

The data for control patients covered a similar period of time to the intervention patients. Controls were selected from the same neighbourhoods as intervention patients. We matched each ECS patient to one control, and each EPC patient to two control individuals. A larger potential control pool existed for EPC patients given their somewhat younger age and lower baseline risk profile as compared to ECS patients. A larger matched control group improves the technical performance of the matching process.

For ECS, the matched control group comprised 1,626 records (hereafter referred to as ECS matched controls) from 1,438 unique individuals. For EPC, the matched control group comprised 6,022 records (hereafter referred to as EPC matched controls) from 3,772 unique individuals. Matching was done 'without replacement', so the same control record could not be assigned to multiple intervention patients. As control patients were re-entered monthly, the same patient could be included multiple times as a control, but with different start dates. None of the control patients were re-entered so often it would invalidate the result.

While the matching algorithm aimed to find a matched control group that was as similar as possible to the intervention group based on the variables that we observed, the two groups may differ in ways that we could not observe. For instance, we were aware that social isolation and additional support needs play a factor in the referral of patients, particularly for EPC. It was not possible to include these factors in our matching approach or risk adjustment, as this information is not routinely collected in NHS data.

One way to check for the likely presence of unobserved differences is to look at the mortality rates of the ECS and EPC patients compared with their matched controls. As we did not expect either intervention to affect death rates, a difference in mortality might suggest unmeasured differences between the groups, such as social isolation.[13] Both ECS and EPC have low clinical risk as they improve primary services based in the community, and it is implausible that either would cause an observable difference in mortality rates during the time frames covered by this study. Health coaching and other primary care or social support offered by multiple teams of accredited professionals are not known to have adverse impacts for patient safety and can have a positive impact on safety from better medication adherence and side effect management.[14] Multiple randomised controlled trials and reviews have found that care models similar to ECS and EPC have no impact on mortality.[15,16,17]

Risk adjustment

We used multivariable regression analysis to risk adjust for the differences between ECS and EPC patients and their matched controls. The aim of this adjustment was to statistically control for any known differences that remained between the two groups after matching. Any differences that continued to be observed between intervention and control groups after matching in age, prior admissions and long-term health conditions might explain some of the relative difference in how often the two groups used hospital services after referral to ECS or EPC. The regression adjusted for these differences but could not adjust for unobserved variables that were not recorded in our data sets, such as the degree of family support, social isolation, and the ability of patients to manage their health conditions. This was a particular challenge for assessing EPC, as these variables were part of the core referral and eligibility criteria for the service.

The regression models produced 'best estimates' of the relative difference in hospital use between ECS or EPC patients and the matched control groups, together with 95% confidence intervals. The confidence intervals show some of the uncertainty in the results by providing a range around the best estimate in which we can be relatively certain the true value lies. But the additional uncertainty due to the risk of unobserved differences between the two groups is not captured by the confidence intervals, so the results need to be interpreted with caution.

Outcome measures

Once matched control groups were selected, the IAU compared the hospital use of patients referred to ECS or EPC with the respective matched controls. Hospital activity was measured from the individual's study start to the end of the study (mid-August 2018), or when the individual left the area or died.

The following measures relating to hospital use were analysed (please see the SAP[3] for detail):

- A&E attendances
- emergency admissions
- total bed days following emergency admissions (ie total number of bed days across all emergency admissions), excluding same-day admissions
- emergency admissions for chronic ambulatory care sensitive (ACS) conditions (see further list of these conditions in Box 1)
- emergency admissions for urgent care sensitive (UCS) conditions (see Box 1).

Other hospital care measures were also analysed:

- elective* admissions
- total bed days following elective admissions, excluding same-day admissions

* Elective admissions are defined as those that are 'ordinary' or day cases and exclude maternity and regular day/night cases.

- outpatient attendances (excluding appointments that the patient did not attend)
- proportion of deaths in hospital (as a proxy for dying in preferred place of death, where it is assumed that individuals prefer not to die in hospital).

Box 1: Conditions for which emergency admissions may be avoidable

The analysis included two outcome measures relating to emergency admissions that could potentially have been avoided, with further detail on data definitions in the SAP.[3] However, sometimes people need to be admitted to hospital for these conditions, regardless of the quality of the care offered. Although these measures are not perfect, we would expect ECS and EPC to have greater impact on admissions for these conditions than others.

The measures, which have overlapping conditions, are defined in the CCG Improvement and Assessment Framework.[18]

Chronic ambulatory care sensitive conditions are long-term conditions for which the risk of emergency admissions may be reduced by timely and effective primary and community care. These include:

- chronic viral hepatitis B
- diabetes
- anaemia
- dementia
- epilepsy
- cardiovascular disease, such as heart failure and angina
- respiratory disease, such as asthma and bronchitis.

Urgent care sensitive conditions are conditions that may sometimes be dealt with effectively by the urgent and emergency care system (such as ambulance services or A&E) without emergency hospital admission. These include:

- chronic obstructive pulmonary disease
- acute mental health crisis
- non-specific chest pain
- falls (patients aged 74 and over)
- non-specific abdominal pain
- cellulitis (infections of the skin and subcutaneous tissue)
- blocked tubes, catheters and feeding tubes
- hypoglycaemia
- urinary tract infection
- angina
- epileptic fit
- minor head injury.

We identified admissions for chronic ambulatory care sensitive conditions and urgent care sensitive conditions using the primary diagnosis in the admission record. There is some limited overlap in these definitions, so it is possible though rare for one admission record to be both.

Results of the Extensive Care Service (ECS) evaluation

Baseline characteristics for ECS and matched controls

Patients who used the ECS model were on average 80 years old and 51% were male. They had an average predicted risk score (based on the Combined Predictive Model) of 51.4 out a maximum of 100, a broad range of pre-existing health conditions, and significant history of using hospital services prior to ECS. In particular, 43% had mental ill health and 33% had suffered from renal failure.

Compared with the group of potential control patients (before matching), ECS patients were on average much older, more likely to be male, more likely to have white ethnicity, and less likely to live in a rural setting. Reflecting the risk stratification criteria used to determine which patients were referred into ECS, ECS patients had a much higher average number of LTCs associated with frailty (1.03, SD 1.22 as opposed to 0.37, SD 0.78).

As expected, patients in the matched control group had similar characteristics to ECS patients with an average age of 80 (vs 80 for ECS patients) and 0.91 LTCs linked to frailty (vs 1.03) – see Table 1. A small proportion (260 people, or 16%) of ECS patients had also used EPC either before or after ECS enrolment. In most cases, EPC was used as a step-down for ECS, and so people received this service after EPC. After matching, a very similar proportion of the controls (13.7%) had been enrolled on EPC.

Looking at individual LTCs and types of hospital activity, ECS patients and matched controls were generally similar, within a standardised mean difference (SMD) under 10% for most variables.* For nearly all LTCs and historic activity measures, ECS patients nevertheless had slightly higher hospital use or more LTCs than matched controls. Some of these differences were more substantial and showed an SMD between the intervention and control groups of more than 10% even after the matching algorithm was applied:

- **Long-term conditions:** ECS patients were more likely than matched controls to have a recorded diagnosis of cognitive impairment, anxiety or depression, functional dependence, mobility problems, complicated diabetes, fluid and electrolyte disorders, uncomplicated hypertension, liver disease, obesity, and hemiplegia or paraplegia.
- **Historic hospital use:** ECS patients recorded on average more A&E attendances in the year and 2 months prior to being enrolled onto ECS than matched controls, as well as more emergency admissions in the 2 years prior, and more urgent care sensitive admissions in the 2 months and 2 years prior.

In later statistical analysis, we adjusted for these differences using regression techniques.

On average, ECS patients were observed for 393 days after their ECS start date and matched controls were observed for 375 days. This equates to about 13 months for both ECS patients and matched controls. For more detail on how similar the two groups were across demographic, LTC, and historic activity characteristics at baseline, see Table 1.

* The SMD is defined as the difference in means as a proportion of the pooled standard deviation. Please see the SAP for details here: https://www.health.org.uk/sites/default/files/2020-01/fylde_coast_nhs_vanguard_statistical_analysis_protocol.pdf

Table 1: Baseline characteristics derived from hospital data of ECS intervention patients, matched controls, and the potential control pool prior to matching

Variable	Intervention group – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Total number of records	1,626	1,626	57,954
Age	80 [73, 85]	80 [73, 85]	72 [64, 80]
Male	50.7%	50.9%	47.0%
White	94.9%	96%	89.4%
Rural setting	8.1%	7.7%	9.2%
Number of LTCs linked to frailty	1.03 (1.22)	0.91 (1.21)	0.37 (0.78)
Test bed telehealth monitoring flag	8.7%	4.3%	0.1%
Enrolment in EPC	16.0%	13.7%	2.3%
Cognitive impairment	22.9%	20.7%	7.3%
Anxiety or depression	22.0%	19.1%	9.5%
Delirium	6.1%	5.6%	1.6%
Dementia (frailty)	18.1%	17.3%	6.4%
Functional dependence	2.8%	2.6%	0.6%
Fall or significant fracture	28.4%	27.1%	11.7%
Incontinence	8.3%	6.3%	2.8%
Mobility problems	10.4%	7.4%	2.5%
Pressure ulcers	4.0%	3.8%	1.2%
Senility	2.4%	1.8%	0.5%
Dementia	11.3%	12.8%	4.6%
Rheumatoid arthritis	8.5%	6.9%	3.2%
Cardiovascular disease	13.0%	9.7%	4.9%
Mental ill health (generic)	42.7%	39.2%	24.8%
Myocardial infarction	32.9%	26.1%	8.9%
Miscellaneous cognitive dysfunction	17.8%	14.6%	6.2%

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different ECS patients). These 1,626 follow-up records represent 1,438 unique individuals; the distribution of baseline characteristics is very similar between records and individuals.

Variable	Intervention group – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Alcohol abuse	6.4%	4.9%	4.9%
Blood loss anaemia	frequency <10 individuals†	freq <10	0.0%
Deficiency anaemia	13.3%	8.5%	2.8%
Cardiac arrhythmia	51.7%	43.4%	14.9%
Congestive heart failure	42.0%	34.4%	6.7%
Coagulopathy	1.7%	0.7%	0.6%
Chronic pulmonary disease	48.1%	38.9%	18.2%
Depression	16.9%	14.7%	7.2%
Diabetes, complicated	12.1%	9.7%	1.9%
Diabetes, uncomplicated	42.9%	35.5%	13.9%
Drug abuse	freq <10	NA	0.2%
Fluid and electrolyte disorders	25.5%	18.8%	6.2%
Hypertension, complicated	0.9%	freq <10	0.2%
Hypertension, uncomplicated	74.0%	73.2%	45.2%
Hypothyroidism	12.5%	9.6%	7.0%
Liver disease	3.8%	2.0%	1.6%
Lymphoma	freq <10	freq <10	0.7%
Other neurological disorders	10.1%	7.9%	4.4%
Obesity	9.6%	6.8%	3.8%
Peptic ulcer disease excl bleeding	3.3%	2.0%	1.5%
Hemiplegia/paraplegia	2.0%	0.9%	0.7%
Psychoses	1.0%	0.7%	0.7%
Pulmonary circulation disorders	5.8%	3.5%	1.4%
Renal failure	33.4%	26.8%	8.1%

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different ECS patients). These 1,626 follow-up records represent 1,438 unique individuals; the distribution of baseline characteristics is very similar between records and individuals.

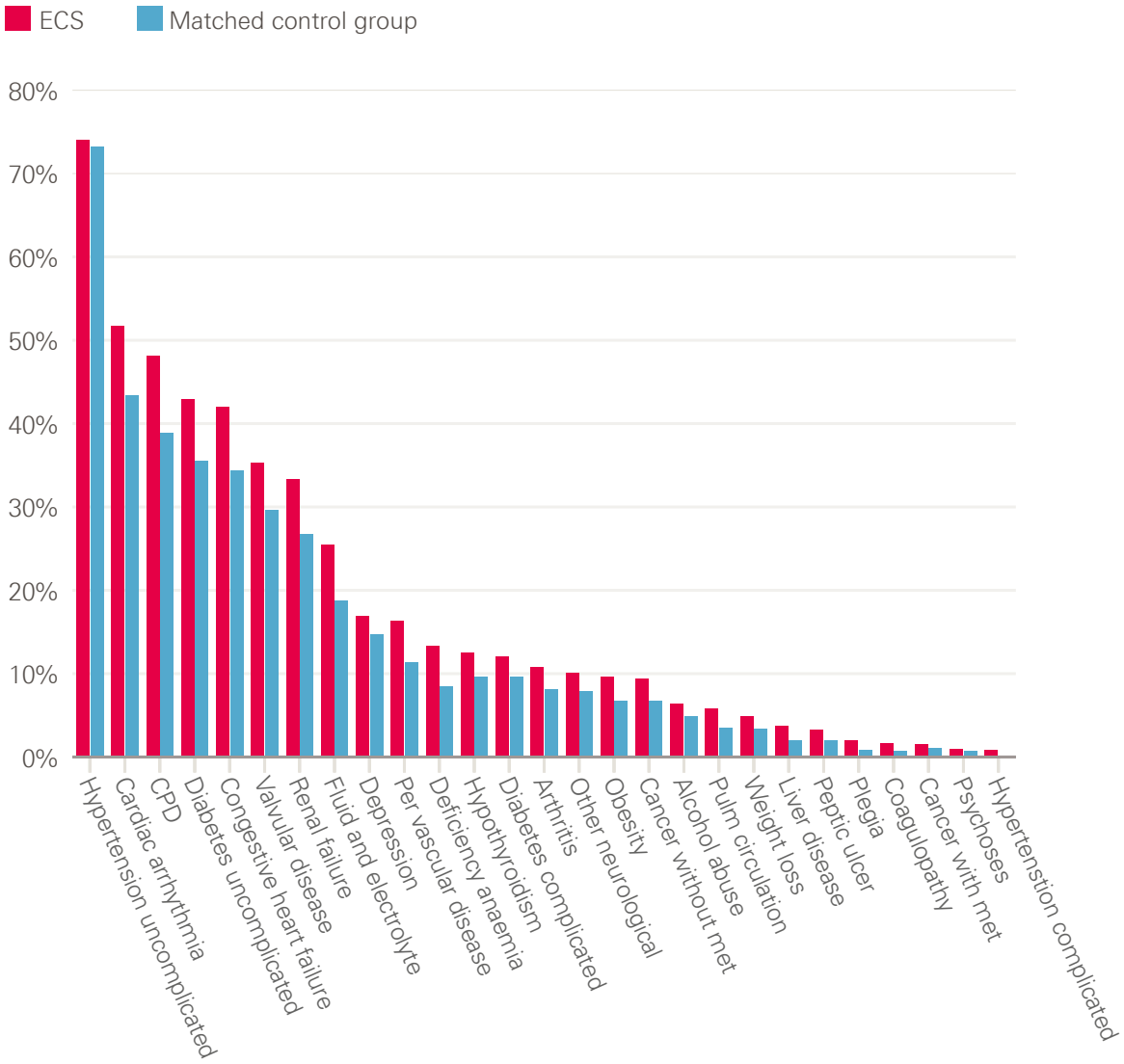
† In line with national policy requirements and our data sharing agreements, the IAU suppresses these 'potentially disclosive' data with small counts to maintain patient confidentiality.

Variable	Intervention group – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Rheumatoid arthritis	10.8%	8.1%	4.4%
Solid tumour with metastasis	1.5%	1.1%	2.1%
Solid tumour without metastasis	9.4%	6.8%	9.0%
Valvular disease	35.3%	29.7%	8.4%
Weight loss (Elixhauser, 3 years look-back)	4.9%	3.4%	1.9%
Peripheral vascular disease	16.3%	11.4%	4.1%
Emergency admissions in prior 2 months	0.31 (0.62)	0.30 (0.58)	0.15 (0.39)
Emergency admissions in prior year	1.45 (1.78)	1.26 (1.43)	0.37 (0.78)
Emergency admissions in year before prior year	0.88 (1.36)	0.69 (1.18)	0.21 (0.67)
Emergency chronic ambulatory care sensitive admissions in prior 2 months	0.08 (0.34)	0.08 (0.31)	0.02 (0.13)
Emergency chronic ambulatory care sensitive admissions in prior year	0.37 (1.00)	0.31 (0.79)	0.04 (0.24)
Emergency chronic ambulatory care sensitive admissions in year before prior year	0.18 (0.61)	0.14 (0.47)	0.02 (0.20)
Urgent care sensitive (UCS) emergency admissions 2 months prior	0.09 (0.36)	0.08 (0.32)	0.03 (0.16)
UCS emergency admissions in prior year	0.42 (1.06)	0.32 (0.83)	0.07 (0.34)
UCS emergency admissions before prior year	0.24 (0.71)	0.17 (0.54)	0.05 (0.29)
A&E attendances in year before prior year	1.14 (1.96)	0.88 (1.48)	0.32 (0.93)
A&E attendances in prior 2 months	0.39 (0.74)	0.34 (0.65)	0.19 (0.45)
A&E attendances in prior year	1.82 (2.29)	1.52 (1.79)	0.52 (1.07)
Outpatient appointments in prior year	6.44 (6.27)	5.30 (4.74)	3.56 (4.37)
Ordinary elective admissions in prior year	0.92 (1.86)	0.76 (1.24)	0.83 (2.18)
Number of emergency hospital bed days in prior year	13.49 (21.89)	11.17 (19.37)	3.26 (13.52)
Number of elective hospital bed days in prior year	0.86 (4.61)	0.49 (3.41)	0.49 (4.02)
Predicted risk score	51.40 (21.62)	48.60 (19.46)	24.20 (15.68)

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different ECS patients). These 1,626 follow-up records represent 1,438 unique individuals; the distribution of baseline characteristics is very similar between records and individuals.

Figure 1: Standardised mean differences (SMD) of baseline characteristics between ECS intervention patients and controls, before and after matching

Figure 2: Percentage of patients with various health conditions at time of ECS start, across intervention patients and matched controls



Note: the figure is based on the diagnoses recorded on the inpatient record during the 3 years prior to starting ECS.

Between the time patients were enrolled onto the ECS service and the end of the period covered by the evaluation in mid-April 2018, 330 patients died, compared with 266 matched control individuals. Therefore, ECS users had a higher crude mortality rate than the matched controls (20.3% of ECS patients compared with 16.4% of matched controls). However, after adjusting for the remaining differences between the characteristics of the two groups, there was no evidence that ECS patients had a higher death rate than the matched control patients (4% higher odds of dying; 95% confidence interval: 16% lower to 28% higher, p-value=0.714). This finding gave us more confidence that we had found an appropriate matched control group, despite the differences in standardised mean differences seen in Figure 1. It does not preclude the possibility that ECS patients may have been different from matched controls in unobserved ways, such as in the availability of family support. This finding indicates that baseline risk associated with death was relatively similar and well balanced between the intervention and the matched control groups.

Outcomes excluded from the report

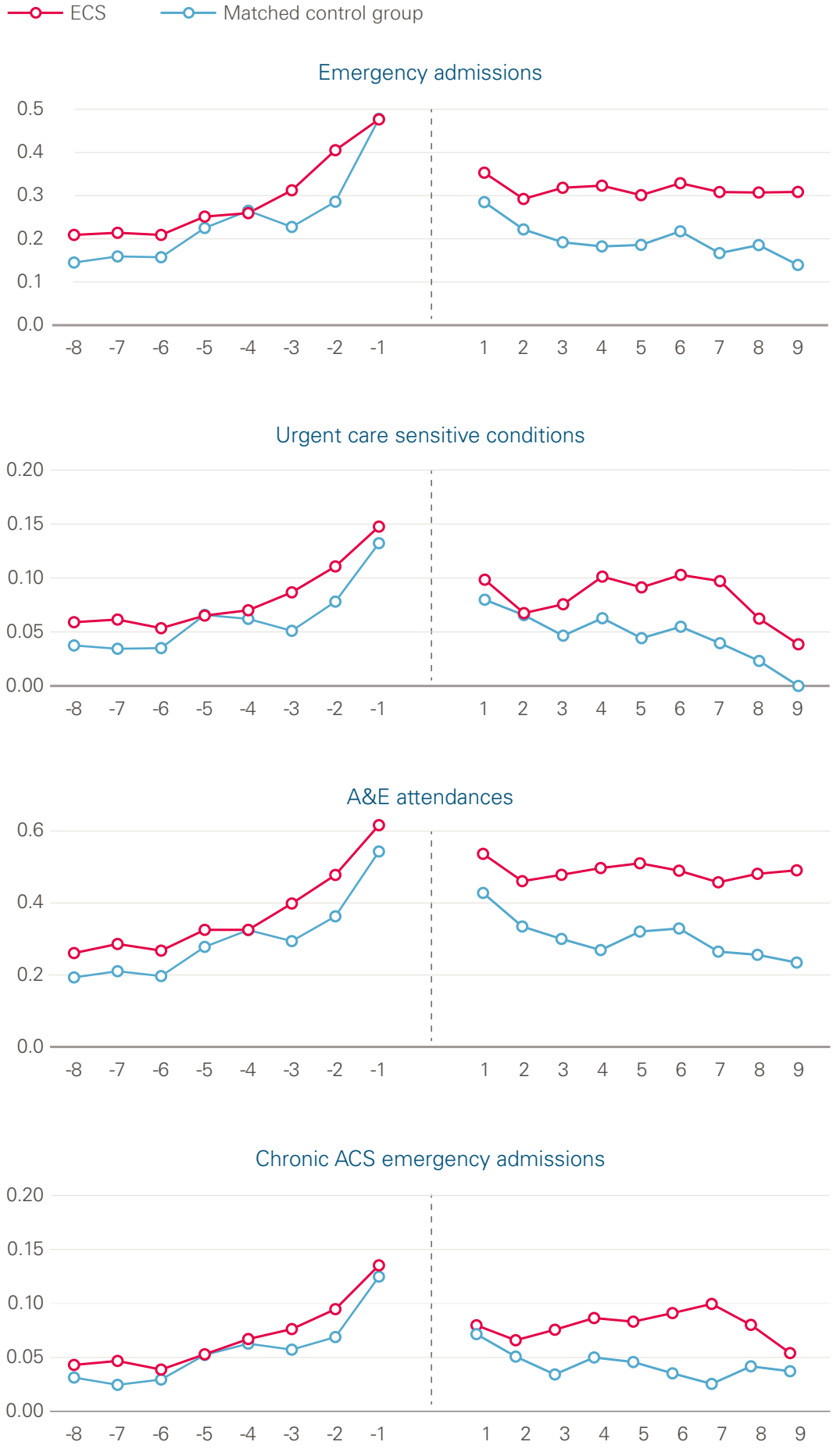
When comparing the ECS and matched control groups on the outcome measures for emergency bed days, elective bed days, ordinary elective attendances, and outpatient attendances, it was not possible to adjust for any of the observed differences that remained between the groups after matching. This was because of sparse data that made it technically unfeasible to fit statistical models for these outcomes. We do not consider findings for these outcomes to be informative, and thus do not present them for the ECS evaluation.

Trends in hospital use

We assessed how ECS patients' hospital use changed over time. The left-hand side of each chart in Figure 3 shows crude rates of hospital use (per person per quarter) before they were enrolled into ECS. The intervention patients exhibited a steady increase in hospital use in the year before enrolment. This finding is consistent with GPs and other health care workers referring patients with high risk of going into crisis. The observation underlines the importance of using a control group, since we would expect patients with this profile to show reductions in hospital use over time as the acuity of their crisis reduces over time, due to a statistical phenomenon called 'regression to the mean'. Our matched control group showed a similar increase in hospital use to the ECS patients, which adds to our confidence that the two groups were similar.

The right-hand side of each chart shows hospital use after study entry. ECS patients appeared to use more emergency hospital care in the first 4 quarters after starting the service than the matched control patients. This pattern was seen for all of the outcome measures shown.

Figure 3: Crude rates of hospital use in ECS patients and matched controls (number per patient per quarter)



ECS patients used hospital care more often than matched controls

Table 2 compares the emergency hospital use of ECS patients after enrolment with the hospital use of matched control individuals over the same period. We found strong statistical evidence that after enrolment onto ECS, intervention patients had higher rates of A&E attendance, emergency admission, and chronic ACS admission than matched controls.

ECS patients attended A&E an average of 1.64 times per year, compared with 1.11 times per year among the matched control patients. After adjusting for remaining observed differences in the baseline characteristics of the two groups, ECS patients attended A&E 26% more often than the matched control patients (95% confidence interval: 15–38% more often). This means that ECS patients went to A&E on average 0.29 more times per person per year than the matched control patients (95% confidence interval: 0.16 to 0.42 more).

After enrolment, ECS patients were admitted to hospital as an emergency an average of 1.28 times per year, compared with 0.87 times for the matched control patients. After adjustment, ECS patients underwent emergency admission 27% more often (95% confidence interval: 15–41% more often) than the matched control patients, which is equivalent to ECS patients experiencing on average 0.24 more emergency admissions per person per year than the matched control patients (95% confidence interval: 0.13 to 0.35 more).

ECS patients had on average 0.32 admissions for chronic ambulatory care sensitive conditions per person per year, compared with 0.20 among matched control patients. After adjustment, these admissions were found to occur 62% more frequently among ECS patients than matched control patients (95% confidence interval: 33–98% more frequent), which equates to 0.12 more of these admissions per person per year (95% confidence interval: 0.07 to 0.20 more).

ECS patients had on average 0.35 emergency admissions for urgent care sensitive conditions per person per year, compared with 0.23 in the matched control group. After adjustment, ECS patients were admitted as an emergency for such conditions 24% more often than matched control patients (95% confidence interval: 3–48% more often), which equates to 0.05 more of these admissions per person per year (95% confidence interval: 0.01 to 0.11 more).

Figure 4: Estimated effect on hospital use of ECS, compared to matched controls
Estimates and 95% confidence intervals shown for treatment effects are after regression adjustment for remaining differences after matching.

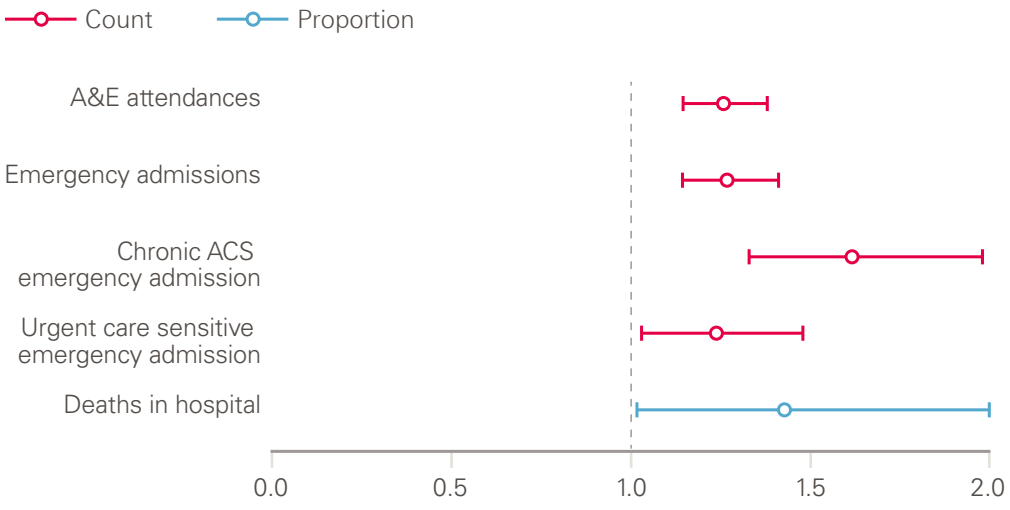


Table 2: Comparison of the rate of unplanned hospital use between ECS patients and matched control group

	Crude rates (number per person per year)		Absolute differences (per person per year, adjusted)		Relative difference (adjusted rate ratio)		P-value
	ECS patients	Matched controls	Best estimate	95% confidence interval	Best estimate	95% confidence interval	
A&E attendances	1.64	1.11	0.29 more	0.16 to 0.42 more	26% higher	15% to 38% higher	<0.001
Emergency admissions	1.28	0.87	0.24 more	0.13 to 0.35 more	27% higher	15% to 41% higher	<0.001
Chronic ACS emergency admission	0.32	0.2	0.12 more	0.07 to 0.2 more	62% higher	33% to 98% higher	<0.001
Urgent care sensitive emergency admission	0.35	0.23	0.05 more	0.01 to 0.11 more	24% higher	3% to 48% higher	0.022

There was no clear assocation between ECS and dying in hospital

Of the patients who died, a higher percentage of people in the ECS group died in hospital (64.5%) than matched control individuals (54.9%). After adjustment, ECS patients were 43% more likely to die in hospital than matched controls (95% confidence interval: 2–100% higher; p-value: 0.037). ECS patients may have been more likely to die in hospital rather than in their preferred place of death, but this finding ought to be noted with caution as we are unable to adjust for all factors included in the matching.

Table 3: Comparison of rates of death in hospital between ECS and matched control groups

	Percentage of deaths in hospital (unadjusted)		Relative difference (adjusted odds ratio)		P-value
	ECS patients	Matched control group	Best estimate	95% confidence interval	
Deaths in hospital	213 (64.5%)	146 (54.9%)	43% higher	2% to 100% higher	0.037

Patterns do not appear to change when reducing follow-up time

We conducted additional analysis to check whether ECS had a more time-limited impact on hospital use. We applied a 12-month cap to the follow-up period and examined whether intervention patients demonstrated a reduction in hospital use as compared to their matched controls over this shorter period. This analysis was used to identify whether there was a short-term effect of ECS on the outcome measures.

As we significantly reduced the total time for available patient observations in this further analysis, reliable statistical estimates could not be generated for all study outcomes. However, the analysis found indications of greater A&E attendance and emergency admissions even with shorter follow-up.

Detailed findings from this subgroup analysis are presented in Annex 1.

Results of the Enhanced Primary Care (EPC) evaluation

Baseline characteristics for EPC and matched controls

As planned under the Fylde Coast vanguard's population health strategy, patients who used EPC were somewhat younger and healthier than ECS patients. However, the EPC patients who met the inclusion criteria for our study exhibited substantial overlap in baseline characteristics with those who used ECS.

EPC patients were on average 76 years old, albeit with a somewhat wider distribution of ages than ECS. Their mean predicted risk score, reflecting many types of pre-existing chronic diagnosis and prior hospital activity, was 32.91 out a maximum of 100. In contrast to ECS where males formed a small majority of patients, only 41% of EPC patients were male. 43% of EPC patients had mental ill health and 52% had uncomplicated hypertension. 28% had a record of chronic pulmonary disease.

Compared with the general adult population in the Fylde Coast who were never referred to this service, EPC patients were on average more likely to be female, more likely to have white ethnicity, and less likely to live in a rural setting. EPC patients had more LTCs associated with frailty compared with all potential controls (average 0.89, SD 1.13 as opposed to 0.26, SD 0.62). Some differences in baseline characteristics persisted after matching, but balance was improved across nearly every risk indicator such as age, risk score, and within nearly all prior LTC flags and hospital use history.

Nearly all remaining gaps between the EPC and matched control groups fell within a standardised mean difference of 10% or less. Patients in the matched control group had an average age of 75 (vs 76 for EPC patients) and an average of 0.79 LTCs linked to frailty (vs 0.89). In contrast to ECS, a number of EPC patients had no hospital-recorded diagnosis of an LTC and/or hospital activity; but as EPC enrolment entails a clinical assessment and referral typically by GP or another professional, these patients might have an LTC diagnosed in primary care that we could not account for in our analysis.

For several factors the standardised mean difference between EPC patients and matched controls exceeded 10%:

- **Long-term conditions:** EPC patients were more likely than matched controls to have a recorded diagnosis of cognitive impairment, pressure ulcers, cancer without metastases, and valvular disease.
- **Historic hospital use:** EPC patients recorded more A&E attendances on average in the year prior to enrolment than matched controls.

In our subsequent statistical analysis, we adjusted for these remaining observed differences using regression techniques. However, there may still be unobserved differences between the groups.

On average, EPC patients were observed for 198 days and matched controls for 220 days. This is about 6.5 months of follow-up for EPC patients and 7.2 months for matched controls, with the small discrepancy arising from different rates of migration and death early in the study period. For more detail on how closely matched the two groups were across demographic, LTC, and historic activity characteristics at baseline, see Table 4.

Table 4: Baseline characteristics of EPC intervention patients, matched controls, and the potential control pool prior to matching

Variable	Intervention – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Total number of unique records	3,011	6,022	113,771
Total number of records	3,011	6,022	113,771
Age at study start	76 [63, 85]	75 [62, 83]	57 [42, 71]
Male	40.7%	39.5%	46.5%
White	91.7%	93.2%	87.3%
Rural setting	6.5%	5.7%	8.1%
Number of frailty-associated comorbidities	0.89 (1.13)	0.79 (1.09)	0.24 (0.59)
Test bed telehealth monitoring flag	frequency <10 individuals†	freq <10	0.0%
Cognitive impairment	17.3%	16.4%	3.1%
Anxiety or depression	21.0%	18.4%	11%
Delirium	5.5%	5.4%	0.6%
Dementia (frailty)	14.1%	13.7%	2.7%

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different EPC patients). These 6,022 follow-up records represent 3,722 unique individuals; the distribution of baseline characteristics is very similar between records and individuals; the summary figures given here are for records to maintain consistency with ECS reporting.

† In line with national policy requirements and our data sharing agreements, the IAU suppresses these 'potentially disclosive' data with small counts to maintain patient confidentiality.

Variable	Intervention – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Functional dependence	3.2%	2.9%	0.3%
Fall or significant fracture	24.8%	21.9%	6.7%
Incontinence	7.8%	7.0%	1.4%
Mobility problems	7.5%	5.7%	1.0%
Pressure ulcers	4.2%	3.4%	0.5%
Senility	0.9%	0.8%	0.2%
Dementia	10.4%	9.7%	1.7%
Rheumatoid arthritis	5.6%	4.3%	1.6%
Cardiovascular disease	10.4%	7.8%	2.2%
Mental ill health (generic)	42.8%	40.2%	26.0%
Myocardial infarction	12.7%	9.6%	4.5%
Miscellaneous cognitive dysfunction	13.1%	10.8%	4.8%
Alcohol abuse	7.2%	6.5%	5.7%
Blood loss anaemia	freq <10	0.2%	0.0%
Deficiency anaemia	8.3%	5.5%	1.7%
Cardiac arrhythmia	23.9%	19.7%	7.6%
Congestive heart failure	14.2%	11.4%	3.2%
Coagulopathy	1.4%	disclosive	0.4%
Chronic pulmonary disease	28.3%	24.7%	13.6%
Depression	16.1%	14.3%	8.6%
Diabetes, complicated	4.9%	3.0%	1.1%
Diabetes, uncomplicated	19.1%	15.5%	7.5%
Drug abuse	1.3%	1.3%	1.7%
Fluid and electrolyte disorders	15.3%	12.7%	3.3%
Hypertension, complicated	0.4%	0.2%	0.1%
Hypertension, uncomplicated	51.9%	49.0%	22.4%
Hypothyroidism	9.4%	6.8%	3.9%
Liver disease	4.0%	3.2%	1.3%
Lymphoma	0.9%	0.3%	0.4%
Other neurological disorders	13.2%	8.5%	3.2%

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different EPC patients). These 6,022 follow-up records represent 3,722 unique individuals; the distribution of baseline characteristics is very similar between records and individuals; the summary figures given here are for records to maintain consistency with ECS reporting.

Variable	Intervention – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Obesity	8.7%	5.4%	3.7%
Peptic ulcer disease excluding bleeding	1.9%	1.1%	0.9%
Hemiplegia/paraplegia	3.2%	2.6%	0.4%
Psychoses	1.7%	1.6%	1.0%
Pulmonary circulation disorders	3.2%	2.5%	0.7%
Renal failure	15.2%	11.7%	3.7%
Rheumatoid arthritis	7.1%	5.4%	2.4%
Solid tumour with metastasis	4.1%	3.8%	1.1%
Solid tumour without metastasis	11.1%	8.5%	4.5%
Valvular disease	14.4%	12.0%	4.3%
Weight loss (Elixhauser, 3 years look-back)	3.4%	2.6%	1.2%
Peripheral vascular disease	7.7%	5.9%	2.0%
Emergency admissions in prior 2 months	0.26 (0.53)	0.22 (0.48)	0.10 (0.33)
Emergency admissions in prior year	0.84 (1.25)	0.73 (0.99)	0.27 (0.67)
Emergency admissions in year before prior year	0.46 (0.98)	0.36 (0.85)	0.19 (0.61)
Emergency chronic ambulatory care sensitive admissions in prior 2 months	0.04 (0.19)	0.03 (0.18)	0.01 (0.10)
Emergency chronic ambulatory care sensitive admissions in prior year	0.11 (0.41)	0.08 (0.32)	0.02 (0.20)
Emergency chronic ambulatory care sensitive admissions in year before prior year	0.07 (0.34)	0.05 (0.27)	0.02 (0.16)
Urgent care sensitive (UCS) emergency admissions 2 months prior	0.05 (0.24)	0.04 (0.21)	0.02 (0.15)
UCS emergency admissions in prior year	0.19 (0.66)	0.15 (0.46)	0.06 (0.30)
UCS emergency admissions before prior year	0.12 (0.47)	0.08 (0.35)	0.04 (0.27)
A&E attendances in year before prior year	0.69 (1.55)	0.55 (1.23)	0.38 (1.10)
A&E attendances in prior 2 months	0.32 (0.62)	0.26 (0.54)	0.12 (0.40)
A&E attendances in prior year	1.10 (1.54)	0.95 (1.33)	0.46 (1.12)

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different EPC patients). These 6,022 follow-up records represent 3,722 unique individuals; the distribution of baseline characteristics is very similar between records and individuals; the summary figures given here are for records to maintain consistency with ECS reporting.

Variable	Intervention – ECS [IQR] (SD)	Matched control group* [IQR] (SD)	Potential controls before matching [95% CI] (SD)
Outpatient appointments in prior year	4.76 (5.64)	3.95 (4.38)	2.80 (4.08)
Ordinary elective admissions in prior year	0.91 (2.36)	0.76 (1.94)	0.63 (1.61)
Number of emergency hospital bed days in prior year	10.84 (25.15)	7.49 (20.17)	1.60 (9.20)
Number of elective hospital bed days in prior year	1.13 (8.54)	0.55 (5.73)	0.31 (3.99)
Risk score	32.91 (20.86)	30.17 (17.80)	16.04 (12.02)

* Includes some individuals who were re-entered over different time periods for different intervention patients (ie in some cases the same control patient, over different follow-up periods, was matched to different EPC patients). These 6,022 follow-up records represent 3,722 unique individuals; the distribution of baseline characteristics is very similar between records and individuals; the summary figures given here are for records to maintain consistency with ECS reporting.

Figure 5: Standardised mean differences (SMD) of baseline characteristics between EPC intervention patients and controls, before and after matching

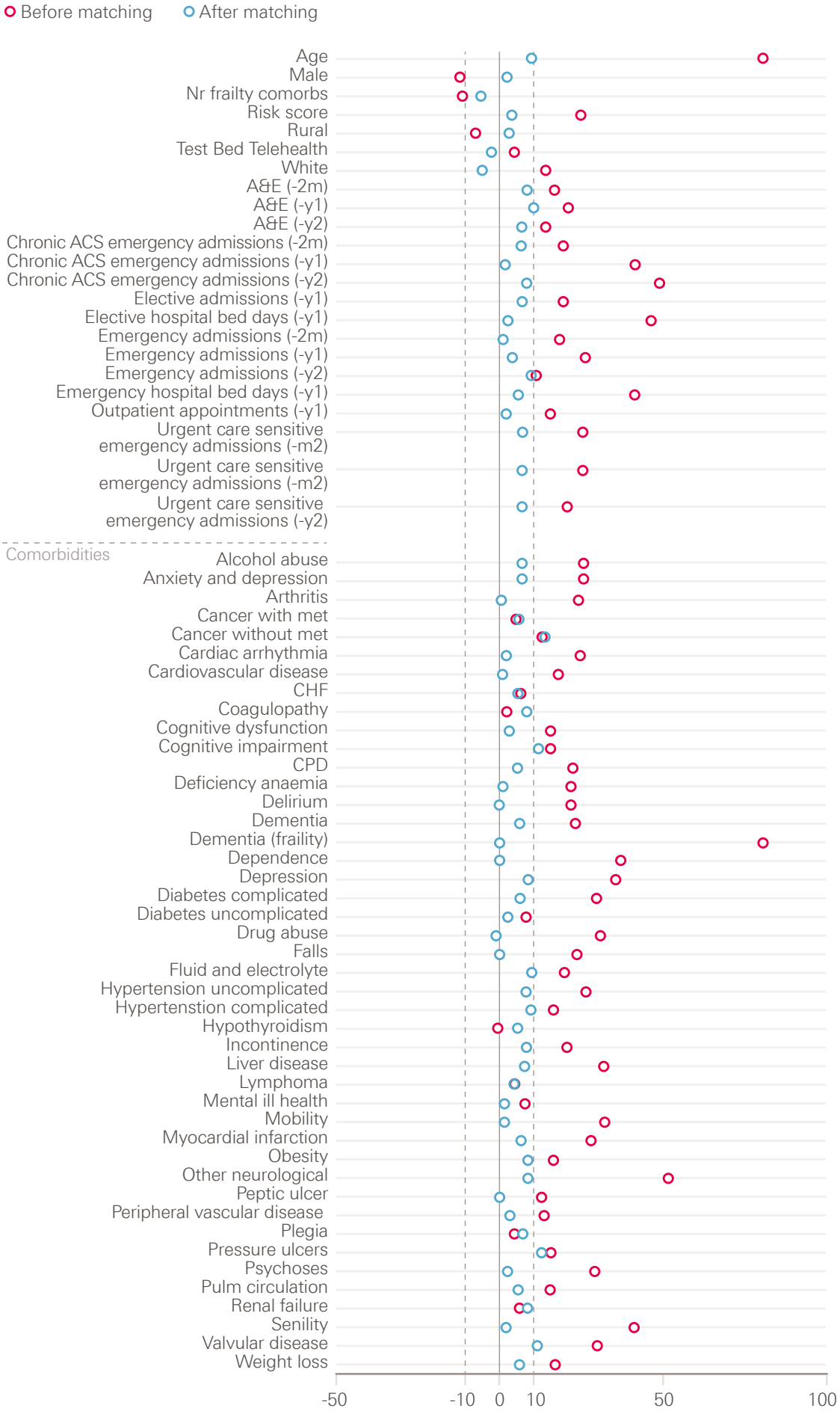
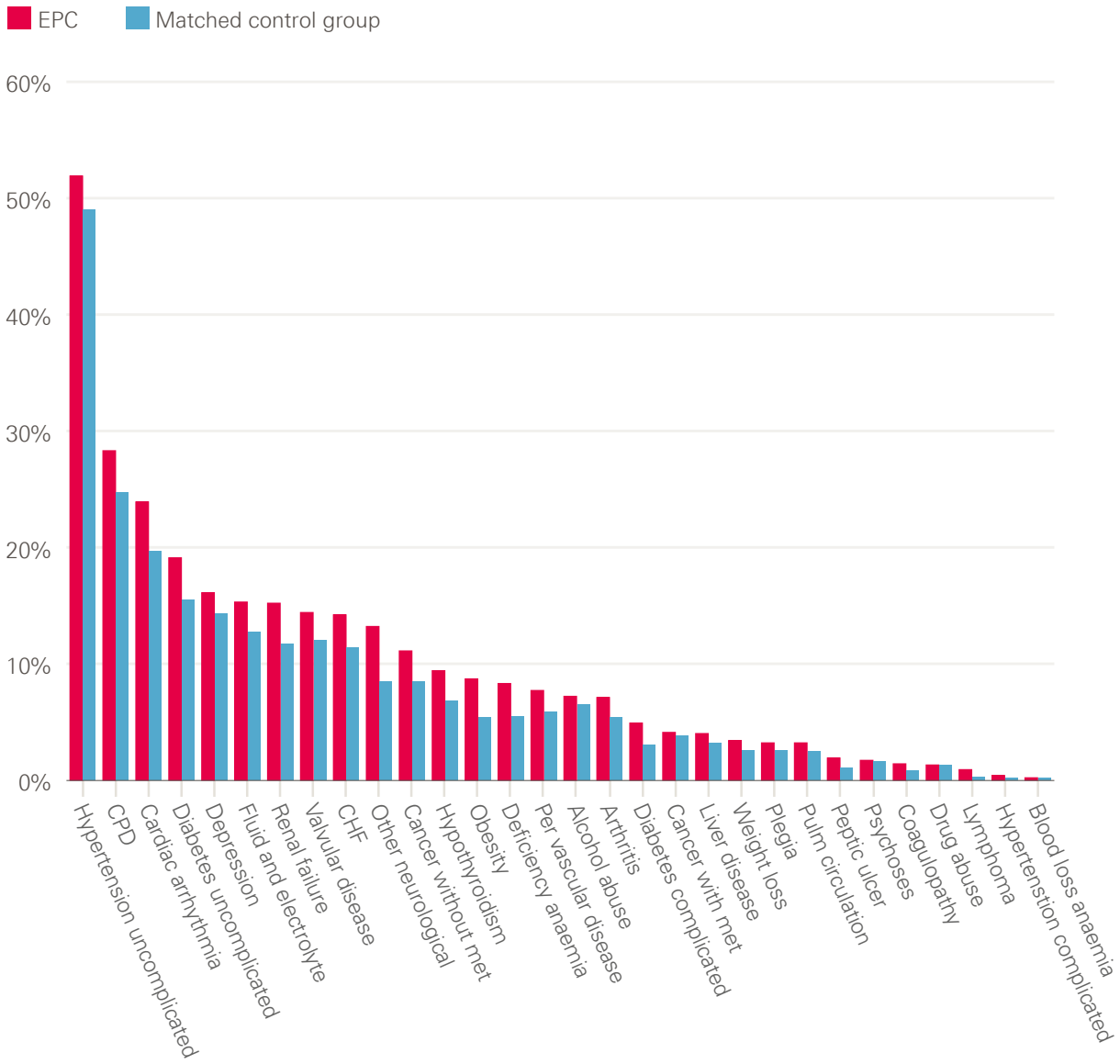


Figure 6: Percentage of patients with various health conditions at time of EPC start



Note: the figure is based on the diagnoses recorded on the inpatient record during the 3 years prior to referral to EPC.

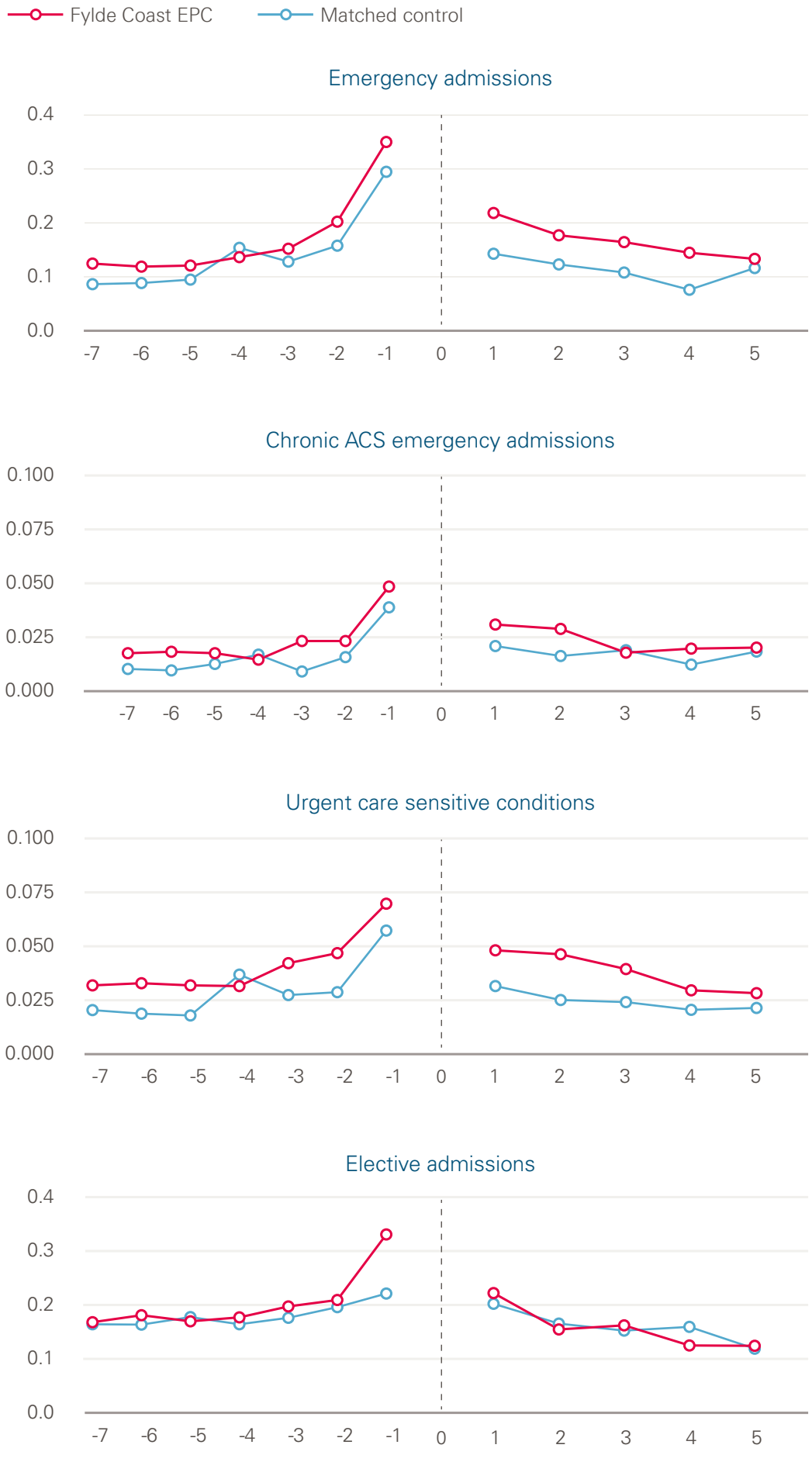
Between the time EPC patients started the intervention and our study end in mid-April 2018, 319 out of 3,011 patients died, compared with 424 of 6,022 matched control records. EPC users had a higher crude mortality rate than the matched controls (10.6% EPC vs 7.0%). After adjusting for remaining differences between the characteristics of the two groups, there was strong evidence that EPC patients had a higher death rate than the matched control patients (58% higher odds of dying; 95% confidence interval: 33–89% higher, p-value<0.001).

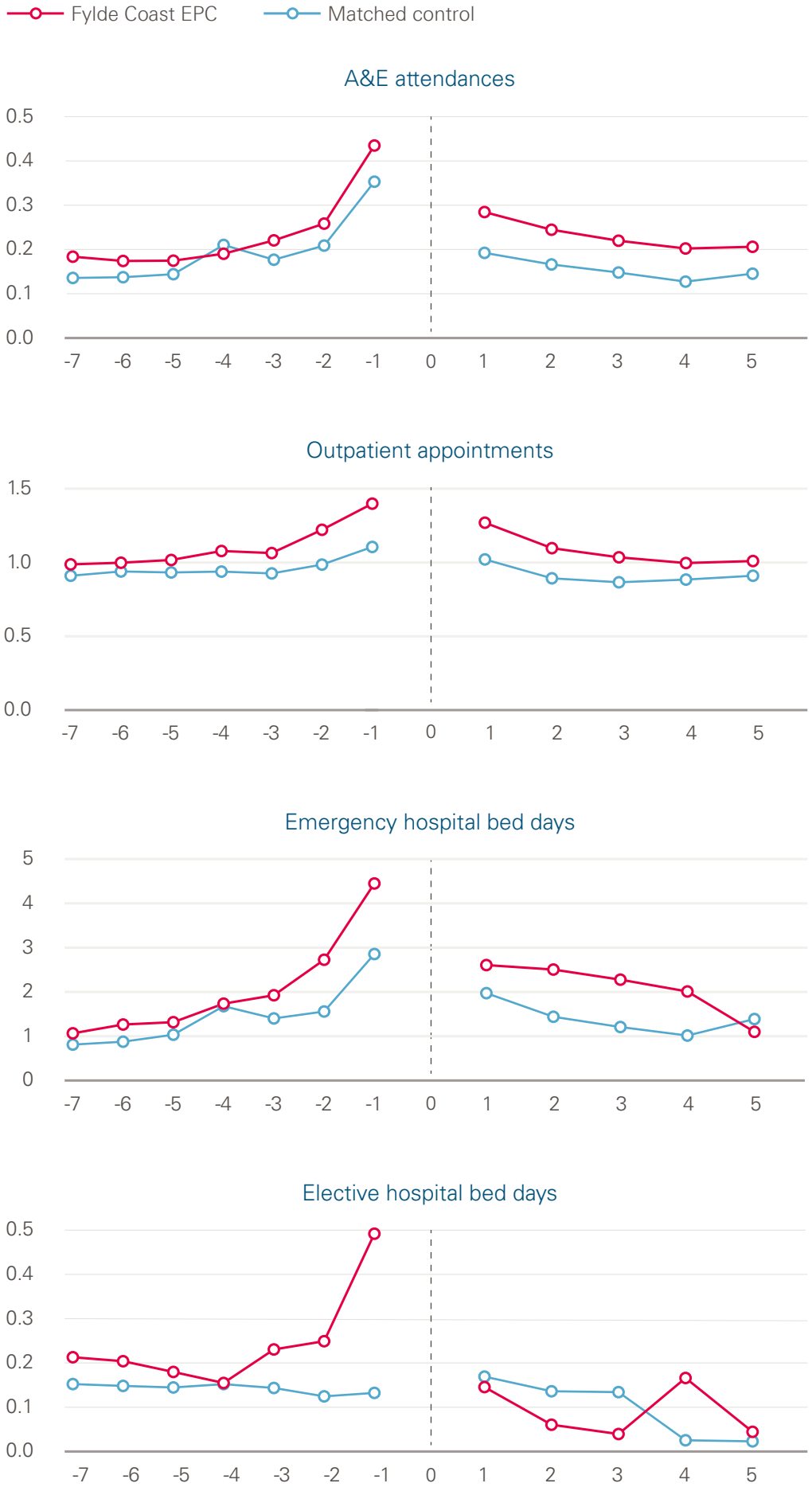
As previously discussed, mortality rate is a diagnostic check on the robustness of our statistical techniques. The remaining mortality difference we observe between EPC users and their matched controls during our follow-up strongly suggests other unobserved differences in baseline risk, even after matching. Notably, this significant gap in the death rate is similar if slightly larger in magnitude to the differences we observed between the groups in hospital use, at least for our primary study outcomes. Thus, we interpret the results for EPC with a great deal of caution as the diagnostic suggests that EPC users had unobserved but fundamentally important starting risks that were greater than for their matched controls; for example, disease severity or social isolation.

Trends in hospital use

We assessed how EPC patients' hospital use changed over time. The left-hand side of each chart in Figure 7 shows crude rates of hospital use (per patient per quarter) before they started using EPC. To a similar but less pronounced extent than the ECS cohort, EPC patients exhibited a steady increase in hospital use in the year prior to being enrolled and a gradual decline afterward. Reflecting the same trends observed for ECS, our matched control group also saw increasing hospital activity in the prior period. The right-hand side of each chart shows hospital use after enrolment. After starting the intervention, EPC patients experienced slightly more emergency admissions (including admissions for urgent care sensitive conditions) than matched control patients, as well as more A&E attendances and emergency hospital bed days.

Figure 7: Crude rates of hospital use for EPC patients and matched controls




Fylde Coast EPC
Matched control
A&E attendances
0.5
0.4
0.3
0.2
0.1
0.0
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5
Outpatient appointments
1.5
1.0
0.5
0.0
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5
Emergency hospital bed days
5
4
3
2
1
0
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5
Elective hospital bed days
0.5
0.4
0.3
0.2
0.1
0.0
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5

EPC patients used hospital care more than matched controls

We found strong evidence that after using EPC, intervention patients had higher hospital use than matched controls, a trend that was consistent across nearly every outcome measure. However, there was also strong evidence ($p<0.001$) that EPC patients had fewer elective bed days than matched controls (18% lower rate, 95% confidence interval: 10–25% lower). Table 5 shows the adjusted secondary care rates of EPC patients after starting the intervention, compared with matched control individuals over the same period. The absolute difference in hospital use was relatively small between EPC patients and matched controls for chronic ACS and urgent care sensitive emergency admissions. As discussed in detail below, all outcomes ought to be interpreted with caution as we also observed strong evidence ($p<0.001$) for a difference in death rates between EPC users and matched controls. This strongly suggests that other unobserved factors such as social isolation or severity of illness account for some of the observed increases in hospital use among EPC users.

EPC patients attended A&E an average of 1.01 times per year, compared with 0.67 times per year among the matched control patients. After adjusting for remaining observed differences in the baseline characteristics of the two groups, EPC patients attended A&E 40% more often than the matched control patients (95% confidence interval: 28–52% more often). This means that EPC patients went to A&E on average 0.18 more times per person per year than the matched control patients (95% confidence interval: 0.13 to 0.24 more).

After using the service, EPC patients were admitted to hospital as an emergency an average of 0.75 times per year, compared with 0.49 times for the matched control patients. After adjustment, EPC patients underwent emergency admission 42% more often (95% confidence interval: 29–56% more often) than the matched control patients, which is equivalent to EPC patients experiencing on average 0.14 more emergency admissions per person per year than the matched control patients (95% confidence interval: 0.10 to 0.19 more).

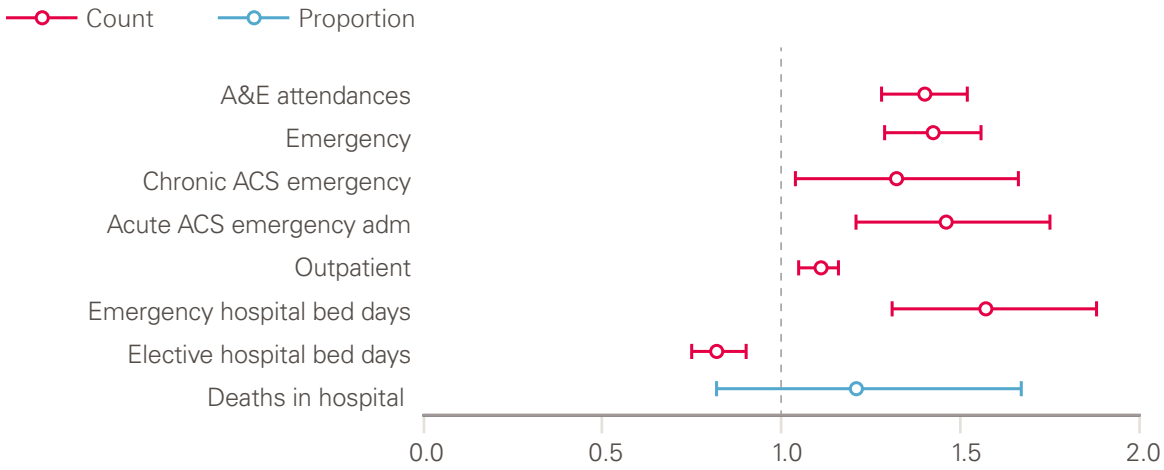
For chronic ambulatory care sensitive (ACS) conditions, EPC patients had on average 0.11 admissions per person per year, compared with 0.07 among matched control patients. After adjustment, chronic ACS admissions were 32% more frequent among EPC patients than matched control patients (95% confidence interval: 4–66% more frequent), which equates to approximately 0.02 more of these admissions per person per year (95% confidence interval: 0.00 to 0.03 more).

For urgent care sensitive conditions (UCS), EPC patients had on average 0.17 emergency admissions per person per year, compared with 0.11 in the matched control group. After adjustment, EPC patients were admitted as an emergency for such conditions 46% more often than matched control patients (95% confidence interval: 21–75% more often), which equates to 0.03 more UCS admissions per person per year (95% confidence interval: 0.01 to 0.05 more).

There was no evidence that ordinary elective attendances were different between EPC patients and matched controls (95% confidence interval: 14% less – 10% more), but there was statistical evidence for a difference in the other outcome measures. EPC patients had on average 0.27 more outpatient attendances (95% confidence interval: 0.13 to 0.42 more), 2.46 more emergency hospital bed days (95% confidence interval: 1.35 to 3.80 more), and 0.06 fewer elective hospital bed days than matched controls (95% confidence interval: 0.04 to 0.09 fewer).

Across all of the above outcome metrics, the differences between EPC users and matched control group are consequential for population health management, although they translate into small absolute differences. This is due to the fact that the majority of EPC users and their matched controls did not have inpatient activity or admissions.

Figure 8: Effect on hospital use for EPC patients, compared with matched controls



Estimates and 95% confidence intervals shown for treatment effects are after regression adjustment for remaining differences after matching.

Table 5: Comparison of the rate of unplanned hospital use between EPC and matched controls

	Crude rates (for number per person per year)		Absolute differences (per person per year, adjusted)		Relative difference (adjusted rate ratio)		P-value
	EPC	Matched control group	Best estimate	95% confidence interval	Best estimate	95% confidence interval	
A&E attendances	1.01	0.67	0.18 more	0.13 to 0.24 more	40% higher	28% to 52% higher	<0.001
Emergency admissions	0.75	0.49	0.14 more	0.1 to 0.19 more	42% higher	29% to 56% higher	<0.001
Chronic ACS emergency admissions	0.11	0.07	0.02 more	0 lower to 0.03 more	32% higher	4% to 66% higher	0.02
Urgent care sensitive emergency admissions	0.17	0.11	0.03 more	0.01 to 0.05 more	46% higher	21% to 75% higher	<0.001
Ordinary elective attendances	0.74	0.72	0.01 fewer	0.07 lower to 0.05 more	2% lower	14% lower to 10% higher	0.689
Outpatient attendances	4.6	3.77	0.27 more	0.13 to 0.42 more	11% higher	5% to 16% higher	<0.001
Emergency hospital bed days	0.034 (0.101)	0.024 (0.095)	2.46 more	1.35 to 3.8 more	57% higher	31% to 88% higher	<0.001
Elective hospital bed days	0.001 (0.015)	0.002 (0.02)	0.06 fewer	0.09 to 0.04 fewer	18% lower	25% to 10% lower	<0.001

Uncertain impact of EPC on deaths in hospital

There was no evidence that EPC patients had a different rate of death in hospital to matched controls. It is possible that our study was underpowered to detect differences in EPC patients and matched controls, as numbers of deaths in hospital were relatively low. Comparative figures for deaths in hospital are shown in Table 6.

Table 6: Comparison of rates of death in hospital between EPC and matched control groups

	Percentage of deaths in hospital (unadjusted)		Relative difference (adjusted odds ratio)		P-value
	EPC	Matched control group	Best estimate	95% confidence interval	
Deaths in hospital	152/319 (47.6%)	186/424 (43.9%)	21% higher	12% lower to 67% higher	0.238

The differences in hospital use were similar for people with mental health conditions

We conducted pre-specified analysis to check whether a subset of EPC patients with mental ill health showed any difference in impact as compared to all EPC users. Because EPC was designed to cater for individuals with social and personal as well as medical needs (for instance, financial hardship), it was plausible that the service would be more beneficial to patients with mental health conditions than other users. It was also plausible that weaker or worse effects would be shown, given the many links between mental ill health with long-term social determinants and personal factors.[18]

A relatively large number (n=1,512, or 50.2%) of EPC users had a recorded long-term mental condition. Similarly, a large number of matched control patients had these conditions (2,787 or 46.3% of follow-up records). Within the subgroup of individuals who had a history of mental ill health, we again found greater unplanned hospital use among EPC users compared with matched controls. Patterns in outcome measures were very consistent with the above results for the overall study population.

Detailed findings from this subgroup analysis are presented in Annex 2.

Discussion

Evaluating the impact of complex changes to service delivery can be challenging. It is often not possible to introduce service changes through a randomised controlled trial (RCT) that would allow an unbiased comparison between an intervention group and a control group. This means that patients who are selected for an intervention often differ markedly from those who are not. In this study, we attempted to select a subset of 'matched controls' that more closely resembled the intervention patients than the population as a whole. However, this method relies on a number of assumptions that must be considered carefully.

We applied a series of diagnostic tests to assess whether these assumptions are likely to be true; for example we looked carefully at the similarity of the matched control group to the intervention patients, and we also compared the death rates of the two groups. These diagnostic tests did not provide the level of reassurance for this study that we have seen in other studies. For example, many of the baseline differences exceeded our 10% threshold for the standardised difference. For the EPC evaluation (though not the ECS evaluation) the matched control group experienced significantly lower mortality than the intervention group. This means that compared with other studies we have produced, we can be less confident that the differences detected in hospital use represent the impact of the care models being evaluated, particularly for EPC.

In light of these limitations, it is important to be cautious when drawing conclusions from this work. One possible interpretation is that ECS did not reduce (but may have increased) hospital activity during the study period we examined. It is harder to interpret the EPC findings though it is possible this intervention also did not reduce hospital use.

Strengths and limitations

Differences between intervention and matched control groups

The matched control residents had broadly similar age, gender, health conditions and previous hospital use to ECS and EPC users. They lived in the same Fylde Coast region, and sub-regional neighbourhoods, which were broadly similar in terms of provision of health care and access to similar services. By choosing matched control residents living in the same Fylde Coast vanguard area and even neighbourhood hub, we ensured that the two groups were more likely to be similar in ways that could not be observed or measured and also that both groups had access to the same health services. Furthermore, our statistical evaluation used sophisticated matching of intervention patients to control patients and risk-adjusted analyses, which control for known factors that can impact hospital use. However, there are likely to be unobserved differences between the ECS and EPC patients and their respective matched controls that were not (or could not be) measured, such as presence or absence of informal care received at home, severity of illness, and quality of hospital care. Such factors almost certainly played a role in a GP or other professional's decision to refer individuals to ECS and EPC.

In the ECS evaluation we found that intervention patients had largely similar rates of long-term conditions to the matched control group and similar rates of secondary care activity, but with some significant differences. Compared with their matched controls,

intervention patients were more likely to have cognitive impairment, anxiety or depression, functional dependence, mobility problems, complicated diabetes, fluid and electrolyte disorders, uncomplicated hypertension, liver disease, obesity, and hemiplegia or paraplegia. Intervention patients had higher levels of A&E attendance than matched controls in the year prior to being enrolled onto ECS, as well as slightly higher rates of emergency admissions and urgent care sensitive admissions. As the subsequent risk adjustment might not completely control for these remaining differences between the two groups in addition to the risk of further unobserved differences between the two groups, we cannot say for sure that the differences in hospital use after enrolment onto ECS are a result of the intervention.

In the EPC evaluation, there was a slightly but consistently higher prevalence of LTCs and higher hospital use across most indicators for the intervention group than the matched controls, even though the differences were relatively small. This systemic difference was smaller in magnitude than observed in ECS. We did see a difference in death rate between service users and matched controls, which strongly suggests that this evaluation suffered from unobserved differences between the intervention patients and their matched controls prior to the intervention. Due to the remaining differences in mortality between EPC patients and matched controls, we cannot conclude that all of the observed differences in hospital use are attributable to the intervention. It is not uncommon for patients to have a number of emergency admissions in the period prior to death, and this fact could account for some of the additional admissions seen in the intervention group. The higher death rate might also indicate a generally higher level of health need among the intervention group, again potentially explaining the higher emergency admissions. However, it is possible that the higher mortality does not explain all of the observed difference in hospital use between EPC patients and their matched controls.

It is not uncommon for integrated care initiatives to have limited impact on hospital utilisation, or in fact lead to an increase of hospital use, at least in the early stages. An inconclusive result or increase in hospital use has been found in many previous evaluations of community-based ICTs,[15,16,17,19,20] including other IAU studies.[21,22] There are several plausible explanations for why both ECS and EPC might increase hospital use, which are borne out by local accounts. In many instances staff discovered previously unmet needs. Through their work, they improved patient access to care by streamlining referrals and coordinating care plans, and this might have led to more admissions. Fylde Coast managers have expressed concerns about the potential for care dependency among ECS patients who receive a more intensive and comprehensive service than routine primary care.[10] One explanation for the observed increase in hospital use is the patient acuity cited by staff.[10] The potential to reduce hospital use for these patients may be limited compared with patients with less acute health needs and a slightly lower risk of admission.

The observed increase in hospital use may be inherent to the way ECS and EPC patients were targeted and intensively managed. The teams delivering both models of care, as well as hospital staff, may have been more risk averse and applied a lower clinical threshold when making decisions about hospital referral and admission for patients who were known to be using these services, particularly as ECS may have introduced some discontinuity in the

provision of primary care. ECS and EPC faced initial delays in staff recruitment and delays in setting up operational processes,[6,10] which may have meant that some care had to be delivered in hospital.

Another limitation to our study is the relatively short average follow-up periods (13 months and 7 months respectively). It is possible that reductions in hospital use from integrated care initiatives such as ECS and EPC would only materialise after a longer follow-up period. ECS was inspired by the American CareMore model, which required nearly 8 years to observe sufficient reduction in hospital outcomes to be self-financing.[23] Recent analysis from the Improvement Analytics Unit shows a delayed effect on hospital use in Mid Nottinghamshire, where it was not till years 5 and 6 after their integrated care transformation programme started that we observed a reduction in A&E attendance and emergency admissions.[24]

Other strengths and limitations

This evaluation focused on hospital use, since one of the objectives of the Fylde Coast vanguard was to reduce the use of unplanned emergency care. It does not tell us how ECS and EPC affected other parts of the care system such as primary or social care, whether these care models achieved against their aims to improve individuals' wellbeing or quality of life, or whether the introduction of the ECS and EPC services affected staff satisfaction and capability. Local mixed method evaluation was carried out over the course of 1 year by the vanguard's internal team with advisory support from Lancaster University. The internal formative and summative evaluation found:

> *'[For ECS], data and evidence gathered through patient and carer surveys, narratives (the 'lived experience'), the Friends and Family Test (FFT) and reports from staff, evidence a high level of patient satisfaction and experience in ECS.*
>
> *Perceptions held by staff suggested that patients didn't benefit enough due to their level of acuity. However, patients have told us, in their feedback, that small differences in how they feel and improved motivation are significant positive outcomes to them. Patients cited a number of benefits, including; the support given by their wellbeing worker, the responsiveness of the service, and the continuity of care.*
>
> *Overall the findings suggest that the most positive accounts of change are linked primarily to the commitment of the workforce to meet the vision. The provision of a seamless, proactive service that meets the full spectrum of health and wellbeing needs of each neighbourhood… have combined to make a real difference…*
>
> *[For] EPC, [the programme] has emerged from a traditional community service and is still developing as a model of care. Despite its infancy, … [patients] have benefited by new approaches to referral and triage, resulting in more efficient and timely pathways of care for patients with fewer 'handoffs'… The patient survey and patient narratives indicate that patients' overall experiences of the service were very positive. They appear to value the service and particularly individuals within the service that were*

named. The role of the Wellbeing Worker and Care Coordinator appear to be highly valued and instances where staff acted as an advocate, around housing benefits and attending appointments with their patients, seem to be appreciated.'[10]

This suggests the programme may have resulted in more streamlined referral pathways with fewer care handoffs; greater 'patient activation' or capability to self-manage health; more positive subjective experience and patient satisfaction with care; and improvements in staff satisfaction, confidence in skills, and morale from introducing these services in Fylde Coast, particularly ECS.[10] All these impacts were important policy objectives alongside the vanguard ambition to reduce unplanned hospital use. The observed increases in rates of A&E attendances and emergency needs for ECS and EPC patients might also reflect a positive effect on the health and wellbeing of patients by identifying unmet need.

Finally, the finding of a difference in death rates is more likely to signal the presence of important unseen differences such as more severe illness or social isolation among EPC patients compared to the control group, even after matching. For both models of care, referrals made by care professionals may be based on information that was not available in our data sets, such as the acuity of a patient's condition, access to care provided in the community or access to informal care. Social isolation is another factor not captured in routine data that is known to be associated with hospital use among some patients.[13,19,25] This is a general limitation of all observational study designs and firmer conclusions would likely only be available from qualitative studies or through a randomised trial.

Conclusion

After statistically adjusting for differences between the two groups we found that ECS and EPC patients had higher use of most hospital care than matched control patients. For example, emergency admissions were 27% (95% confidence interval: 15% to 41%) higher for ECS and 42% (29% to 56%) higher for EPC patients than their respective matched controls. Similar trends were apparent across other measures of hospitalisation. The study has some limitations, most notably that even after using robust statistical methods, there were remaining observable differences between intervention and matched control groups. Matched control individuals were slightly but notably less ill than the intervention patients. The death rate was higher in the EPC intervention group than in matched controls, which strongly suggests greater baseline risk in this group prior to receiving EPC that could not be accounted for in the accessible data. We cannot be sure whether the higher rates of hospital use could be explained by unobserved differences in the characteristics of the ECS, EPC and the respective matched control groups. However, it appears unlikely that unobserved differences could explain all of the much higher hospital activity among ECS and EPC patients.

We interpret the findings to show that ECS did not reduce (but may have increased) hospital activity. Although the uncertainty around EPC is somewhat higher, it is possible this initiative also did not reduce hospital use in the period covered by this study. The possibility that these care models reduce emergency hospital use over a longer follow-up period, for specific patient subgroups, or when adjusted for social isolation, is being explored in further IAU research on three multidisciplinary teams including ECS and EPC.

Although this evaluation cannot provide a definitive answer to the question of how these new models of care have impacted on hospital use, the considerations set out above will be useful for NHS teams and decision-makers across the broader care system when exploring the use of integrated care teams (ICTs) in the community for high risk individuals.

Increases in hospitalisation outcome measures were observed for both ECS and EPC, and the consistency of these results and similar findings from many other evaluations suggests caution in setting and managing short-term performance objectives when introducing ICTs, for instance in the primary care networks set out in the NHS Long Term Plan: '£4.5bn of new investment will fund expanded community multidisciplinary teams'.[26] Longer-term benefits may well be realised, but our previous work shows it may take up to 6 years before integrated care initiatives translate to a reduction in hospital use.

Annex 1: ECS further analyses

ECS patients used hospital more than matched controls in the 12 months after starting the service

Fylde Coast vanguard managers raised the possibility that most of the beneficial impact of the programmes might only be seen during and immediately after use of the service, particularly for ECS. The IAU consequently conducted 'post hoc' analyses restricting the study follow-up period to 3, 6 and 12 months after the ECS team accepted an intervention patient, as compared to their matched controls over the same shortened period. As designed by the Fylde Coast vanguard, the normal period of care under ECS is 6 months.[15] However, initial cohorts of service users were enrolled on ECS for somewhat longer as programme implementation was refined. We show results for a 12-month maximum follow-up here, in light of this, and because 3- and 6-month periods were relatively too short to reliably observe statistical differences in outcomes between ECS users and matched controls.

As restrictions on the follow-up period reduce the outcome data points that can be included, statistical power is weaker in this subgroup analysis and we did not find reliable estimates for all outcome measures as in the main study. However, where this was possible, the outcomes showed that ECS patients had more unplanned hospital use, consistent with our overall findings. The outcomes found for a 12-month maximum follow-up period are shown here.

As expected, we had the same sample (n=1,626) of intervention periods and matched controls. However, with maximum follow-up capped at 12 months after entering the study, the average follow-up time is shorter for this subgroup analysis, with ECS patients followed for an average of 8.9 months and matched control individuals for 9.9 months.

Without further adjustment, the crude rates of unplanned hospital use are notably higher among ECS patients than matched controls in the 12 months following intervention, across all the primary outcome measures. The crude death rate was very similar (204 deaths or 12.5% among ECS patients vs 202 or 12.4% among controls), suggesting the two groups had similar baseline risk of needing medical care and implying that the adjusted estimates are robust to unobserved differences. Within 12 months of follow-up, there was no evidence of a difference in the adjusted death rate between ECS patients and their matched controls (best estimate: 2% lower death rate among ECS patients; 95% confidence interval: 21% lower to 22% higher; p-value=0.845).

After regression adjustment for known baseline differences, we found strong statistical evidence that after acceptance into ECS, intervention patients had higher A&E attendances, emergency admissions, and chronic ACS admissions than matched controls. There was no evidence of a difference for urgent care sensitive (UCS) admissions. Table A1 compares the unplanned hospital use of ECS patients after intervention with matched control individuals over the same period, and details absolute as well as relative differences in the primary outcomes that we evaluated.

Table A1: Comparison of the rate of unplanned hospital use between ECS and matched controls for a maximum 12-month follow-up period

	Crude rates (for (number per person per year)		Absolute differences (per person per year, adjusted)		Relative difference (adjusted rate ratio)		P-value
	ECS (n=1,626)	Matched controls (n=1,626)	Best estimate	95% confidence interval	Best estimate	95% confidence interval	
A&E attendances	1.66	1.15	0.14 more	0.07 to 0.21 more	24% higher	12% to 38% higher	<0.001
Emergency admissions	1.30	0.92	0.11 more	0.05 to 0.18 more	25% higher	12% to 39% higher	<0.001
Chronic ACS emergency admissions	0.31	0.22	0.04 more	0.01 to 0.08 more	39% higher	12% to 72% higher	0.002
Urgent care sensitive emergency admissions	0.35	0.23	0.01 more	0.01 fewer to 0.04 more	9% higher	11% lower to 33% higher	0.408

No association between death in hospital and ECS in the 12 months after starting the service

As noted in the SAP,[3] the IAU uses dying in hospital as a proxy measure for not dying in one's preferred place. Of the patients who died in the shorter follow-up period, the crude rate of deaths in hospital was higher for ECS patients (134 events or 65.7% of deaths) than for matched controls (106 events or 52.5% of deaths). However, this sample size is insufficient for a conclusive interpretation. After regression adjustment for the baseline factors associated with dying in hospital, there was no statistical evidence for a difference between the ECS and control groups.

Annex 2: EPC further analyses

Half of EPC patients had hospital-recorded diagnoses of mental ill health

The IAU created an overarching flag for mental ill health, which applied to individuals if they had a hospital-recorded diagnosis in the 3 years prior for at least one of any of the following codes:

- Alcohol abuse
- Anxiety or depression
- Cognitive dysfunction
- Cognitive impairment
- Delirium
- Dementia
- Depression
- Drug abuse
- Mental ill health (generic)
- Psychoses
- Senility

The codes are a composite of indicators routinely collected in NHS secondary data, across Elixhauser and Charlson indices, as well as the inpatient-outpatient-A&E-GP (IPOPAEGP) data set that is used to calculate risk scores by the Combined Predictive Model. We used this group of codes because we found that this improved sensitivity compared to use of the generic mental ill health flag on its own. 172 individuals across the matched data set of both EPC patients and matched control individuals did not have a positive record for the generic flag but had other hospital-recorded diagnoses as above.

Using this combined flag for a history of mental ill health diagnoses, we found 1,512 EPC patients in this subgroup (or 50.2% out of 3,011 in the overall study). Among the group of matched controls, 2,787 or 46.3% of unique follow-up records were retained in the flag, representing 1,682 or 44.6% of the unique individuals.

After adjusting for some of the remaining observed differences between the mental ill health subgroup of EPC users and matched controls, there was weak borderline evidence that EPC users had a higher risk of death (29% higher odds of dying; 95% confidence interval: 1% to 64% higher). This suggests important unseen baseline differences between the two groups. Such factors, such as social isolation before and during EPC treatment, are likely to explain at least part of the observed increase in unplanned hospital use among EPC patients.

EPC patients with mental ill health used hospital more than matched controls

The sample size was large enough in this subgroup to support reliable statistical estimates for all outcome measures, though individuals with mental ill health tended to have a slightly shorter follow-up time than the overall study population. EPC patients in this subgroup had an average follow-up period of 6.4 months, while the matched control individuals were followed for an average of 7.0 months. The slight discrepancy in follow-up time arises from random variation in early study exits, and the same control individual potentially being matched to different EPC users for different follow-up periods.

Without further adjustment, the crude rates of unplanned hospital use were higher among EPC patients than matched controls for all outcome measures. The crude death rate was relatively similar (172 deaths or 11.4% among EPC patients vs 256 deaths or 9.2% among controls). There was borderline statistical evidence that this gap persisted even after regression adjustment for baseline risk factors. Consistent with the overall findings for EPC, this points to a 'confounding' role from important unseen factors, meaning that impact results ought to be interpreted with considerable caution.

The results for this subgroup were very consistent with the findings for all EPC users. After adjusting for known baseline differences, we found strong statistical evidence ($p<0.001$) that after using EPC, intervention patients with a history of mental ill health had higher A&E attendances and emergency admissions as compared to matched controls, as well as a greater number of emergency bed days. There was also some evidence ($p<0.02$) for a higher rate of urgent care sensitive (UCS) emergency admissions and outpatient attendances in EPC patients. There was no statistical evidence of a difference between groups for the other outcome measures. Table A2 gives full results comparing EPC users with controls, when both have a history of mental ill health. Notably, while the increase in unplanned hospital use across the primary outcomes is consistent with the overall findings for EPC, the magnitude of these increases is lower for those with mental ill health.

Table A2: Comparison of the rate of unplanned hospital use between EPC users with a history of mental ill health and matched controls

	Crude rates (for number per person per year)		Absolute differences (per person per year, adjusted)		Relative difference (adjusted rate ratio)		P-value
	EPC	Matched controls	Best estimate	95% confidence interval	Best estimate	95% confidence interval	
A&E attendances	1.29	0.88	0.23 more	0.14 to 0.32 more	39% higher	25% to 55% higher	<0.001
Emergency admissions	0.95	0.61	0.18 more	0.11 to 0.26 more	44% higher	27% to 63% higher	<0.001
Chronic ACS emergency admissions	0.13	0.08	0.01 more	0.01 lower to 0.04 more	21% higher	11% lower to 63% higher	0.216
Urgent care sensitive emergency admissions	0.24	0.15	0.03 more	0 lower to 0.06 more	31% higher	4% to 64% higher	0.019
Ordinary elective attendances	0.64	0.63	0.01 fewer	0.08 lower to 0.08 more	2% lower	18% lower to 18% higher	0.846
Outpatient attendances	4.48	3.45	0.24 more	0.06 to 0.43 more	10% higher	2% to 19% higher	0.01
Emergency hospital bed days	0.041 (0.112)	0.034 (0.116)	4.11 more	2.02 to 6.8 more	67% higher	33% to 111% higher	<0.001
Elective hospital bed days	0.002 (0.02)	0.001 (0.025)	0.05 more	0.13 lower to 0.42 more	15% higher	38% lower to 119% higher	0.661

Uncertain impact of EPC on deaths in hospital among patients with a history of mental ill health

There was insufficient statistical evidence for any difference in the rate of deaths in hospital, as a proxy for dying in one's preferred place. There is no indication from this study that EPC patients with a history of mental ill health had a different rate of death in hospital to matched controls, though the comparison is between small sample sizes. There were 76 deaths in hospital among EPC patients in this study, as compared to 100 among the matched control group that was approximately twice as large. Comparative figures for deaths in hospital are shown in Table A3.

Table A3: Comparison of rates of death in hospital between EPC users with a history of mental ill health and matched control groups

	Crude rates (for number per person per year)		Relative difference (adjusted odds ratio)		P-value
	EPC	Matched controls	Best estimate	95% confidence interval	
Deaths in hospital	76/172(44.2%)	100/256(39.1%)	23% higher	17% lower to 83% higher	0.291

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Acknowledgements

We would like to acknowledge the contribution of the following individuals: Caroline Gori, Filipe Santos, Richard Brine, Florence Starr, and Edvige Bordone.

We are also grateful for support and advice from the Fylde Coast ICS, comprising staff from both Blackpool and the Fylde & Wyre CCGs: Jeannie Harrop, Karen Connelly, Dr Andrew Weatherburn, Dr Peter Bennett, Peter Tinson, Jackie Routledge, Victoria Ellarby, Davina Upson, and Lorinda Graham. We would also like to thank David Worthington and Katharina Janke of Lancaster University, who advised the Fylde Coast evaluation team and provided useful input for the statistical protocol of this evaluation. We particularly thank Chris Endersby, who led the evaluation process and review of the technical report on behalf of the ICS. We also thank Martin Caunt, Matthew Sharp and Sukhmeet Panesar from NHS England and Improvement for their review of this document and continued support. Finally, we thank Jim Lockyer at the NCDR.

Errors or omissions remain the responsibility of the authors alone.

When referencing this publication please use the following URL:
https://doi.org/10.37829/HF-2020-DA19

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ISBN: 978-1-911615-52-1
Technical report: The impact of Extensive Care Service and Enhanced Primary Care in Fylde Coast
Registered charity number: 286967
Registered company number: 1714937