Bradford Inequalities Research Unit

Findings of the effectiveness evaluation of the Bradford Pro-Active Care Team (PaCT) intervention

Summary report for the Reducing Inequalities in Communities (RIC) programme

Authors: Joe Pryce, Bo Hou, Rachael Moss, Mohammed Hammad, Trevor Sheldon, John Wright, Josie Dickerson Bradford Inequalities Research Unit, Born in Bradford

Version: 1.0., 28th July 2023

Approved by: Josie Dickerson, BIRU Director

BRADFORD INSTITUTE FOR HEALTH RESEARCH
MAKING RESEARCH REAL

NIHR | Applied Research Collaboration Yorkshire and Humber

Executive Summary

Project overview

The Pro-Active Care team (PaCT) is an intervention which provides proactive, holistic short-term care and support for vulnerable individuals aged >18 to help them avoid unplanned hospital care. The intervention offers a multi-disciplinary team of integrated services within three areas of central Bradford and began delivery in October 2020. The intervention was commissioned by Bradford City CCG (now Bradford District and Craven Health and Care Partnership) as part of the Reducing Inequalities in Communities (RIC) programme. The current evidence base for such integrated care models is mixed, with some studies reporting an impact on unplanned hospital admissions and accident and emergency (A&E) attendance and others finding no impact.

Evaluation overview

The main aim of this evaluation is to explore whether the PaCT intervention reduces unplanned hospital admissions and A&E attendances in an ethnically diverse and socio-economically deprived population.

The evaluation used linked routine data in the Connected Bradford database to identify patients who had received PaCT (n= 390) and to create a matched control group (n= 1,560) based on age, gender, ethnicity and comorbid health conditions. A Difference-in-Differences approach was used to compare changes in unplanned hospital admissions and A&E attendances between the intervention and matched control groups from before the intervention to 12 months after discharge from it.

Changes in health-related quality of life (EQ-5D) were collected from PaCT patients (but not matched controls) at the start and the end of their involvement with the intervention.

Findings

The average age for the PaCT intervention patients was 74.3 years (SD = 13.5), 220 (56.4%) were female, and the main ethnic groups were Pakistani heritage (n = 179, 45.9%) and White British (n= 94, 24.1%). The majority of patients (n = 262, 67.2%) lived in the lowest quartile of deprivation. The matched control group was similar on these key characteristics.

Executive Summary

Findings continued

The Difference in Difference analysis found:

1. an odds of unplanned hospital admission 31% lower in the PaCT group than in the matched control group (odds ratio = 0.69; 95% CI: 0.43 to 1.09). However, the confidence interval was wide, meaning we cannot be certain of the effect that the PaCT intervention has on unplanned hospital admissions.

2. an odds of A&E attendances 41% lower in the PaCT group compared to the matched control group (OR= 0.59; 95% CI:0.37 to 0.94 to 1.20). This finding was statistically significant and so is unlikely to be a chance finding.

There was no difference in the impact on unplanned hospital admissions and A&E attendances by ethnicity.

There was an improvement in health-related quality of life (EQ-5D) in patients receiving the intervention of 0.11 (95% CI: 0.06-0.15). However, with no matched control group data we cannot assess whether this change was caused by the PaCT intervention.

Recommendations

Given the significant impact that PaCT has had on A&E attendances, we would recommend that this intervention should continue to be commissioned. Wider roll out across the district could be considered by commissioners, however, to ensure that the service continues to reduce inequalities in health outcomes, the reach of a wider service would need to be carefully monitored.

The longer term impact of PaCT should be revisited in 12 and 24 months' time.

Background

What is PaCT?

The Pro-Active Care team (PaCT) is an intervention which provides proactive, holistic short-term care and support for vulnerable individuals aged >18 years old, alongside their carers and families. The aim of PaCT is to address an individual's (immediate and short-term) needs to help them live well, to help them avoid any unnecessary GP appointments, unplanned hospital admissions or Accident and Emergency (A&E) attendances.

The intervention offers an integrated model of care including a multi-disciplinary team that works alongside local GPs and primary care services including physiotherapy, psychological support, speech and language therapy, dietary advice and occupational therapy. PaCT was implemented in October 2020 and currently provides care within three areas of central Bradford. The intervention was commissioned by Bradford City CCG (now Bradford District and Craven Health and Care Partnership) as part of the Reducing Inequalities in Communities (RIC) programme.

What does the existing evidence tell us?

An evidence review completed at the time of commissioning of PaCT [1] found three relevant systematic reviews relating to similar models of integrated care which also aimed to reduce unplanned hospital care. These reviews reported mixed results.

- The Strategy Unit [2] included five studies and found inconclusive evidence on the impact of new care models on use of healthcare services, with limited evidence of reduced A&E admissions and GP appointments. Staff valued their enhanced roles which led to improved job satisfaction, lower absenteeism and staff turnover. The patient experience of care may also have improved through the use of shared decision making to develop realistic goals, care closer to home and improved access to services.

- Baxter et al. [3] included 167 studies of integrated care models and found evidence that these improved quality of care, increased patient satisfaction and better access to care. Evidence was rated as either inconsistent or limited regarding other outcomes, including system-wide impacts on primary care, secondary care, and health care costs.

- Desmedt et al. [4] included 26 studies in a systematic literature review of the economic impact of integrated care models for patients with chronic diseases. It found that the majority of studies reported positive economic impacts.

In addition, an evaluation by the National Audit Office of 50 sites with integrated care models (as part of the 'Vanguard programme' [5]) highlighted that areas operating integrated care models may have reduced emergency admissions relative to other areas, but may have seen less of a reduction in elective bed days in recent years than non-vanguard areas.

Background

Existing evidence continued

Research which has emerged since the start of this intervention provides more positive findings of the potential impact of integrated care models:

- A systematic review of community-based complex interventions in older people reported that integrated care models are the most likely intervention to allow older patients to maintain their independence [6].

- A study conducted in Norway, which utilised quasi-experimental methods to evaluate a proactive care team intervention [7] in 439 multi-morbid, frail and elderly patients, compared to 779 matched controls. The study reported a significant reduction in unplanned hospital admissions and evidence of promise of a reduction in emergency outpatient visits.

Aim of the evaluation

The main aim of this evaluation is to explore whether the PaCT intervention reduces unplanned hospital admissions and A&E attendances in an ethnically diverse and deprived population of patients living in inner city Bradford. The objectives are to assess whether the PaCT service:

- Reduces unplanned hospital admissions
- Reduces A&E attendances
- Has differential effects for different ethnic groups
- Improves health-related quality of life
- If feasible, the cost consequences of the PaCT intervention

What will this study be able to tell us?

Using a matched control group allows us to reliably assess the impact of PaCT on unplanned hospital admissions and A&E attendances and if there are any differences in the effectiveness of the intervention by the patient's ethnicity.

Using before and after measures with those who received the intervention will tell us whether health-related quality of life improves after the PaCT intervention, but not whether this was a result of the intervention.

What will this study not be able to tell us?

The longer-term impact of PaCT on unplanned hospital admissions and A&E attendances (i.e., beyond 12 months). We cannot look at the impact of this intervention on deprivation because the majority of the population are in the lowest decile of the Index of Multiple Deprivation.

We do not have a matched control group for the health-related quality of life measures therefore we cannot say if any change identified in this measure is caused by the PaCT intervention.

Methods

Study design

To explore whether PaCT reduces unplanned hospital admissions and A&E attendances, we used the quasi-experimental 'Difference-in-Differences' analysis method [10]. This method estimates the effect of a treatment (PaCT) on an outcome (unplanned hospital admissions / A&E attendances) by comparing the average change over time in the outcome for the treatment group to the average change over time for the control group. This method allows us to control for changes in admissions over time which could be caused by other factors, including COVID-19, which affect both the intervention and control groups.

A within-person regression analysis was completed for the EQ-5D to look for a statistically significant change from the start to the end of the intervention. This analysis allowed us to explore whether patients' key characteristics were associated with changes in this measure.

Study outcomes

The primary outcome is:

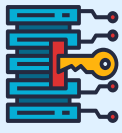
- Unplanned hospital admissions 12 months after discharge from PaCT.

The secondary outcomes are:

- Unplanned hospital admissions 12 months after discharge from PaCT in White British and Pakistani patients.
- Unplanned A&E attendances 12 months after discharge from PaCT.
- Unplanned A&E attendances 12 months after discharge from PaCT in White British and Pakistani patients.
- Change in PaCT patients' health-related quality of life, measured using the EQ-5D utility index [8, 9] at the start and end of the intervention.

Data

Unplanned hospital admissions and A&E attendances



The Connected Bradford dataset was used to evaluate this service. The Connected Bradford [11] dataset stores linked health, education, social care, environmental and other local government data in a pseudonymised form for all individuals registered at GP practices across the Bradford District. The use of routinely collected health data in Connected Bradford reduces the resources that are usually required for data collection and allows research to be undertaken that is based on outcomes directly relevant to policy and practice. Data was extracted from Connected Bradford in May 2023.

A total of 390 patients with a discharge code from the PaCT programme prior to 1st January 2022 were identified. A matched control group was created using demographics such as age, gender, ethnicity, pre-existing health conditions (BMI of 40+, chronic heart disease, chronic kidney disease, chronic liver disease, chronic neurological diseases, chronic respiratory diseases, diabetes, flu pregnancy group, frailty, hypertension, learning disabilities, spleen dysfunction and weak immune system) and an alternative health outcome of planned hospital admissions. Using a nearest matching algorithm with a ratio of 1 to 4, a cohort of 1,560 matched participants was created. Several standard parameters were used to ensure the balance of matching, including standard mean differences, empirical Cumulative Distribution Function (eCDF), variance ratio and standard pair differences.

Data continued

Health-related quality of life

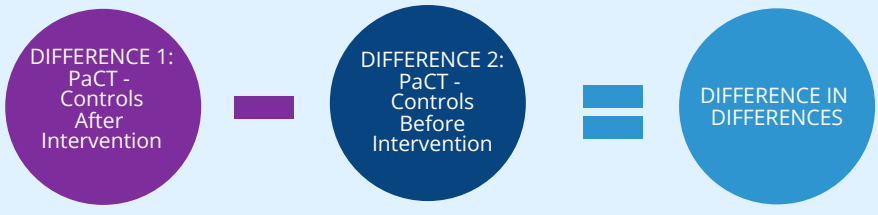
This measure was collected by the intervention staff who asked patients to complete the health-related quality of life (EQ-5D) measure at the start and the end of their involvement in the intervention. No matched control group data was available for these measures.

Analysis

Unplanned hospital admissions and A&E attendances

We conducted a fixed effects Difference-in-Differences regression model to estimate the impact of PaCT participation on unplanned hospital admissions and A&E attendances. We report the impact on both outcomes using odds ratios.
With a sample size of 390, we calculated 86% statistical power to detect a small effect of enrolment in PaCT on unplanned hospital admissions (Cohen's efficient of 0.2).

The Difference-in-Differences analysis looked at: *The difference in the proportion of individuals experiencing one or more unplanned admission / A&E attendance between PaCT and matched controls in the 12 months after discharge from PaCT MINUS The difference in the proportion of individuals experiencing one or more unplanned admission / A&E attendance before any patients were discharged from PaCT.*



The before period included 1st October 2019 to 31st December 2021, and the after period included 1st January 2022 to 31st December 2022. This date maximised the number of patients that could be included in the analysis, as it was the last time point at which every discharged patient could be followed up for a full year post intervention. Patients who died during the follow-up period were excluded from the analysis.

We repeated the Difference-in-Differences evaluation separately for the two largest ethnic groups - White British and Pakistani heritage patients - to assess if there was a difference in effect. We did not look at the 'other' ethnic group as this group contained a heterogeneous mix of different ethnic groups.

Health-related quality of life

To explore whether there were changes in the health-related quality of life from the beginning to the end of the PaCT intervention, we calculated the mean scores and standard deviations of the EQ-5D score. This score was converted into a utility index which ranges from being negative through 0 (a state as bad as being dead) to 1 (full health) [8].

Cost consequences

To identify a per person cost of receiving the PaCT intervention a per person cost of PaCT was calculated by dividing the total annual costs by the total anticipated number of PaCT patients per year.

Results

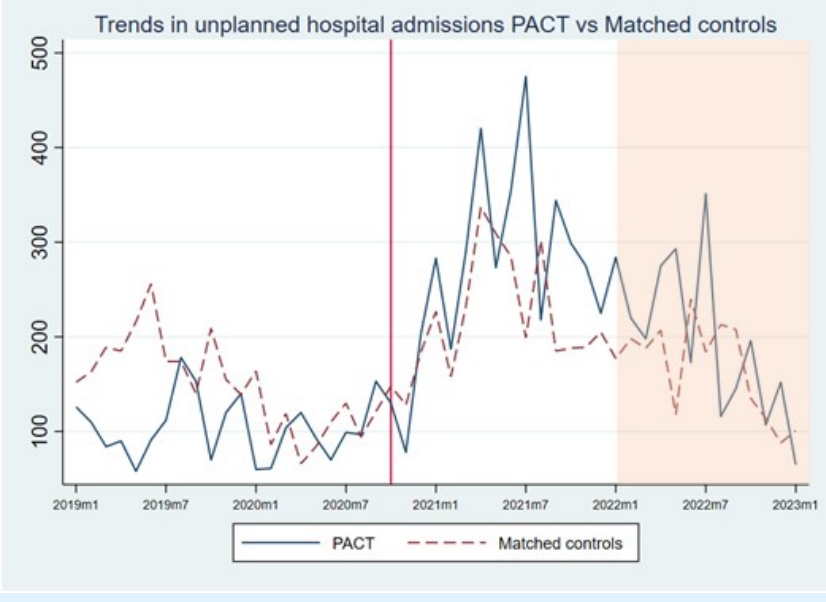
The Population

The average age of the PaCT population was 74.3 years (SD = 13.5), 56.4% were female (n = 220), and the main ethnic groups were Pakistani heritage (45.9%, n = 179) and White British (24.1%, n = 94). The remaining patients belonged to 'other' ethnic groups (32.3%, n = 117). The majority of patients (67.2%, n = 262) lived in the lowest quartile of deprivation. Table 1 (at the end of this report) shows that the intervention and matched control groups were closely aligned on these characteristics.

Monthly trends in hospital admissions

Figure 1 shows the number of monthly unplanned admissions per 1,000 population for both the PaCT group and the matched control group. The rates of admissions attendances were similar between the groups before the intervention was implemented.

Figure 1. Monthly trends in unplanned hospital admissions for the PaCT and matched control groups.

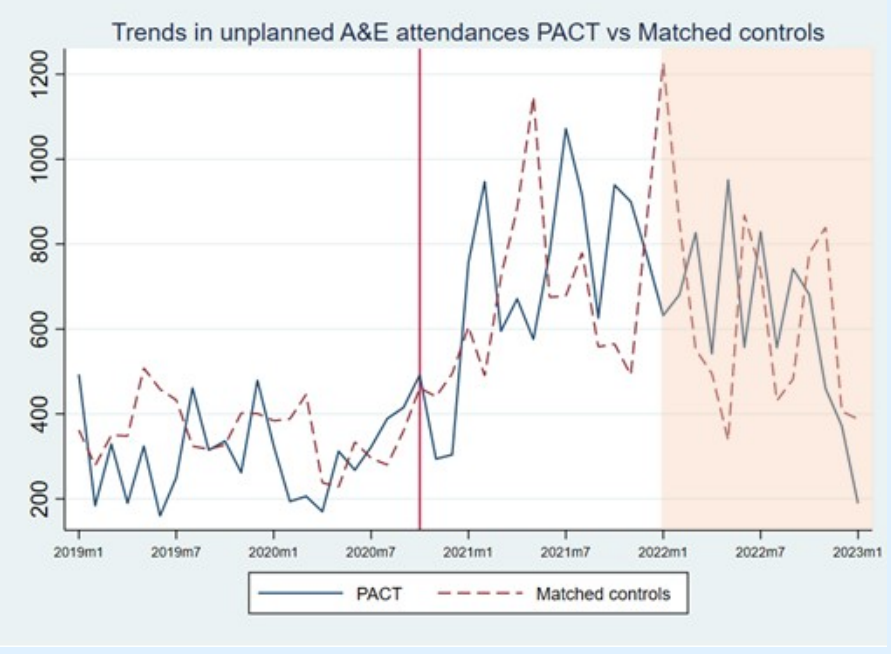


The vertical line indicates the timepoint at which the PaCT programme was officially launched, the shaded area to the right indicates the 'after' period, following the cut-off point used for the difference in difference analysis.

Monthly trends in A&E attendances

Figure 2 shows the number of monthly A&E attendances per 1,000 population for these groups. The rates of A&E attendances were similar between the groups before the intervention was implemented.

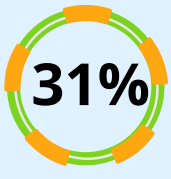
Figure 2. Monthly trends in A & E attendances for the PaCT and matched control groups.



The vertical line indicates the timepoint at which the PaCT programme was officially launched, the shaded area to the right indicates the 'after' period, following the cut-off point used for the difference in difference analysis.

Unplanned hospital admissions

In the PaCT group, 233 (59.7%) participants had an unplanned hospital admission in the 12 months before the PaCT discharge date, reducing to 120 (30.8%) after this date. In the matched control group 493 (31.6%) participants had an unplanned hospitals admission, reducing to 220 (14.1%) in the same time periods.



The Difference-in-Differences analysis found that the PaCT intervention reduced the odds of unplanned hospital admissions by 31% (odds ratio (OR) 0.69; 95% CI: 0.43 - 1.09). However, the confidence intervals in this analysis were wide meaning that we can't be confident in this estimate – the true difference is likely to be anywhere between a 57% reduction and a 9% increase in unplanned admissions.

Subgroup analyses found no difference by ethnicity (White British OR 0.65; 95% CI: 0.22 - 1.93 and Pakistani heritage OR 0.57; 95% CI: 0.29 - 1.10), see Table 2.

Unplanned A&E attendances

In the PaCT group, 290 (74.3%) participants had an unplanned hospital admission in the 12 months before the PaCT discharge date, reducing to 186 (47.7%) after this date. In the matched control group, this number also reduced over time from 715 (45.8%) to 410 (25.7%).

The Difference-in-Differences analysis found that the PaCT intervention reduced the odds of A&E attendances by 41% (OR 0.59; 95% CI 0.37 to 0.94). As the confidence intervals in this analysis were <1.0 we can be certain that the intervention does significantly reduce A&E admissions.

There was no difference in this finding by ethnicity (White British (OR 0.44; 95% CI: 0.13 to 1.42) and Pakistani heritage (OR 0.63; 95% CI: 0.33 to 1.20)).

Health-related quality of life

132

Over the PaCT delivery period of 31 months (October 2020 – May 2023), before and after measures were available for 132 patients. This is only 33.9% of the total number of (discharged) PaCT patients (n=390) in the above analyses.

Table 3 (at the end of the report) shows the characteristics of those who completed the EQ-5D, compared to those in the main analysis. The average age (75.4 years (SD: 12.4)) and the ratio of females (n=71, 52%) to males (n=65, 47%) were similar to patients in the PaCT group in the main analyses, but there were fewer Pakistani heritage patients (n=53, 40%) and more White British patients (n=43, 32%) in this group.

The small proportion of before and after data available and the differences in this population means that these findings might not accurately reflect changes for all PaCT patients and there could have been some selection bias where, for example, those who did complete the measures felt better than those who did not. Importantly, because we have no matched control group data, we cannot compare the change over time for PaCT patients to non-PaCT patients. This means we do not know how much of the changes we found were caused by the PaCT intervention.

For the EQ-5D measure, the average utility index score was 0.44 (SD = 0.28) at the start of the intervention and 0.54 (SD = 0.24) at the end. The increase was 0.12 points (95% CI: 0.059-0.153), denoting a small improvement in quality of life from the start to end of the PaCT intervention. The regression analysis suggested that patients of Pakistani heritage were less likely to have an improvement in health-related quality of life. There was also a positive association with age, indicating that younger patients were more likely to have an increase in health-related quality of life.

Cost consequences

The annual cost of PaCT was budgeted as £1,443,911.00. No anticipated total number of patients was agreed for the PaCT intervention. As a consequence, we could not complete the cost per patients as planned in the methods. However, the PaCT team report a total of 1,297 PaCT patients were referred into the service* between April 2022 and March 2023. Using this referral number, the estimated cost of PaCT is £1,113 per patient per year.

**All referrals received a case note review, triage and phone call, however not all referrals are eligble for, or went on to receive, the full PaCT intervention, therefore this is likely an underestimate of the cost of the intervention.*

Conclusions

Our analysis shows that the PaCT intervention significantly reduces A&E attendances and may reduce unplanned hospital admissions. It is also improves health-related quality of life in those who completed this measure, but we do not know if this is caused by the intervention.

Recommendations for Practice

- Given the significant impact of the PaCT intervention on A&E attendances we would recommend that the service is considered for continued commissioning. Wider roll out across the district could also be considered, however, any such roll out should ensure good integration with other similar services across the system e.g., the Virtual Ward. There should also be careful monitoring of reach to ensure that the service continues to serve those in most need and continues to reduce inequalities in health outcomes.

- We would recommend that the evaluation of PaCT is revisited again in 12 and 24 months' time. This would allow more confidence in the promising unplanned hospital admissions finding and would allow for greater confirmation that there are no differential impacts of the service by ethnicity. It would also allow us to understand the longer-term impacts of this intervention and complete a more in-depth cost consequences evaluation.

References

[1] York Health Economics Consortium (YHEC). (2019). Bradford CCG inequalities reduction programme: Critique of funding proposals. https://borninbradford.nhs.uk/wp-content/uploads/YHEC-for-BIHR_Sept2019.pdf

[2] New models of care – what's the evidence? Summary findings. 2018. https://www.strategyunitwm.nhs.uk/sites/default/files/2019-03/New%20Models%20of%20Care%20-%20What%27s%20the%20evidence%20FINAL.pdf

[3] Baxter S, Johnson M, Chambers D, Sutton A, Goyder E & Booth A. Understanding new models of integrated care in developed countries: a systematic review. Health Serv Deliv Res 2018;6(29) The Strategy Unit. New models of care – what's the evidence? Summary findings. 2018.

[4] Desmedt M, Vertriest S, Hellings J, Bergs J, et al. Economic Impact of Integrated Care Models for Patients with Chronic Diseases: A Systematic Review. Value Health. 2016 Sep - Oct;19(6):892-902. doi: 10.1016/j.jval.2016.05.001.

[5] National Audit Office. 2018. Developing new care models through NHS vanguards. https://www.nao.org.uk/reports/developing-new-care-models-through-nhs-vanguards/

[6] Clegg, A., et al. (2023). *Community-based complex interventions to sustain independence in older people, stratified by frailty: a systematic review and network meta-analysis.* [Manuscript submitted for publication].

[7] Berntsen GK, Dalbakk M, Hurley JS, Bergmo T, Solbakken B, Spansvoll L, Bellika JG, Skrøvseth SO, Brattland T, Rumpsfeld M. Person-centred, integrated and pro-active care for multi-morbid elderly with advanced care needs: a propensity score-matched controlled trial. BMC health services research. 2019 Dec;19(1):1-7.

[8] Herdman, M., Gudex, C., Lloyd, A., Janssen, M. F., Kind, P., Parkin, D., ... & Badia, X. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Quality of life research, 20, 1727-1736.

[9] Andreasen, J., Gobbens, R. J., Eriksen, H. H., & Overvad, K. (2019). Health-related quality of life at hospital discharge as a predictor for 6-month unplanned readmission and all-cause mortality of acutely admitted older medical patients. Quality of Life Research, 28, 3015-3024.

[10] Zeldow, B., & Hatfield, L. A. (2021). Confounding and regression adjustment in difference-in-differences studies. Health services research, 56(5), 932-941.

[11] Sohal, K., Mason, D., Birkinshaw, J., West, J., McEachan, R. R., Elshehaly, M., ... & Wright, J. (2022). Connected Bradford: a whole system data linkage accelerator. Wellcome Open Research, 7.

Tables

Table 1. Characteristics of PaCT and matched controls in the Difference-in-difference analysis

	PaCT cohort (n=390)	Matched controls (n=1,560)
Patients with one or more unplanned admissions before PaCT discharge*	233 (59.7%)	493 (31.6%)
Patients with one or more unplanned admissions after PaCT discharge*	120 (30.8%)	220 (14.1%)
Patients with one or more A&E attendances before PaCT discharge*	290 (74.3%)	715 (45.8%)
Patients with one or more A&E attendances after PaCT discharge*	186 (47.7%)	401 (25.7%)
Death rates	78 (20.0%)	293 (18.8%)
Age (SD)	74.3 (13.5)	74.0 (13.6)
Female	220 (56.4%)	890 (57.1%)
Male	170 (43.6%)	670 (42.9%)
Ethnicity: White British	94 (24.1%)	367 (23.5%)
Ethnicity: Pakistani heritage	179 (45.9%)	714 (45.8%)
Ethnicity: Other ethnic groups	117 (32.3%)	479 (33.6%)
IMD unknown	51 (13.1%)	205 (13.1%)
IMD: Most deprived quartile	262 (67.2%)	1,061 (68.0%)
IMD: 2nd most deprived quartile	62 (15.9%)	235 (15.1%)
IMD: 3rd most deprived quartile	14 (3.6%)	57 (3.7%)
IMD: 4th most deprived quartile	1 (0.3%)	4 (0.1%)
Pre-existing health risk factors: 0 risk factor	26 (6.7%)	83 (5.3%)
Pre-existing health risk factors: 1 risk factor	43 (11.0%)	188 (12.1%)
Pre-existing health risk factors: 2 risk factor	68 (17.4%)	284 (18.2%)
Pre-existing health risk factors: 3 plus risk factor	253 (64.9%)	1,005 (64.4%)
Carer	12 (3.1%)	61 (3.9%)
Pre-PACT Planned hospital attendances: 0 time	119 (30.5%)	722 (46.3%)
Pre-PACT Planned hospital attendances: 1 time	84 (21.5%)	342 (21.9%)
Pre-PACT Planned hospital attendances: more than 1 time	187 (47.9%)	496 (31.8%)

*Cut-off date used for before/after classification = 31st December 2022.

Tables continued

Table 2. The rates of unplanned hospital usage for White British and Pakistani patients before and after the PaCT intervention and Odds Ratio determined by DiD analysis.

	Unplanned hospital admissions		
	Before n (%)	**After n (%)**	**Odds Ratio (95% CI)**
White British PaCT (N = 94) Matched Control (N = 367)	 61 (64.9%) 132 (36.0%)	 33 (35.1%) 51 (13.9%)	 0.65 (0.22 to 1.93)
Pakistani heritage PaCT (N = 179) Matched Control (N = 714)	 102 (57.0%) 208 (29.1%)	 54 (30.2%) 106 (14.9%)	 0.57 (0.29 to 1.10)
	A&E attendances		
	Before n (%)	**After n (%)**	**Odds Ratio (95% CI)**
White British PaCT (N = 94) Matched Control (N = 367)	 69 (73.4%) 171 (46.6%)	 46 (48.9%) 95 (25.9%)	 0.44 (0.13 to 1.42)
Pakistani heritage PaCT (N = 179) Matched Control (N = 714)	 138 (77.1%) 326 (45.7%)	 95 (53.1%) 181 (25.4%)	 0.63 (0.33 to 1.20)

Tables continued

Table 3. The demographic characteristics of patients that completed the EQ-5D at both baseline and discharge, compared to patients in the main analyses.

	PaCT patients with EQ-5D measures (N=132)	**PaCT patients in main analyses (N = 390)**
Age (Mean, SD)	75.4 (12.48)	**74.3 (13.5)**
Gender (N, %)		
Male	65 (47%)	170 (44%)
Female	71 (52%)	220 (56%)
Ethnicity (N, %)		
White British	43 (32%)	94 (24%)
Pakistani	53 (40%)	179 (46%)
Other	38 (27%)	117 (30%)
EQ-5D utility index (Mean, SD)		
Before PaCT	0.44 (0.28)	-
After PaCT	0.54 (0.24)	-