The relationship between research activity and the performance of English general practices: cross sectional and longitudinal analyses

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Abstract

Introduction

Research activity usually improves outcomes by being translated into practice. However, there is developing evidence that research activity itself may improve the overall performance of health care organisations. However, evidence that these relationships represent a causal impact of research activity is less clear. Additionally, the bulk of the existing evidence relates to hospital settings, and it is not known if those relationships would also be found in general practice, where most patient contacts occur. We sought to (a) test whether there were significant relationships between research activity in general practice and organisational performance (b) test whether those relationships were plausibly causal.

Methods

We analysed national data between 2008 and 2019 using cross sectional and longitudinal analyses, on 7921 general practices in England. Research activity included measures from the NIHR Clinical Research Network and the Royal College of General Practitioners. Measures of practice performance included clinical quality of care, patient reported experience of care, prescribing quality and hospital admissions.

Results

In cross-sectional analyses, research activity was positively associated with a number of measures of practice performance, including clinical quality of care, patient reported experience of care, and hospital admissions. The associations were generally modest in magnitude. However, longitudinal analyses did not support a reliable causal relationship.

Conclusions

Similar to findings from hospital settings, research activity in general practice is associated with practice performance. There is less evidence that research is causing those improvements, although this may reflect the limited level of research activity in most practices. We identified no negative impacts, suggesting that research activity is something that high quality practices are able to deliver alongside their core responsibilities and a potential marker of quality.

Introduction

Research is critical to improving quality of care and reducing variation in outcomes. England has a national research infrastructure (National Institute of Health and Care Research Clinical Research Network - NIHR CRN)[1 2] that has supported recruitment of several million patients, including crucial

COVID research platforms.[3–5] There is a desire to further expand research participation, to increase the amount and quality of research, reduce 'research waste',[6] and ensure that research is 'conducted with and in the populations most affected'.[7]

Conventionally, research improves care when it is implemented into practice, although that process typically involves significant delays.[8] However, there is increasing evidence that participation in research by health care organisations may itself be related to better performance and improved patient outcomes – irrespective of the nature of the findings or whether the findings are subsequently implemented. For example, hospital participation in interventional studies in colorectal cancer has been associated with improved survival among the wider patient population cared for by that hospital.[9] Further studies and evidence syntheses have supported this hypothesis.[10–12]

However, evidence linking research activity and organisational performance largely comes from hospital settings, and similar benefits may not occur in general practice. General practices care for different patient populations, provide care that is less technical, and practices are smaller and more geographically distributed than hospitals. Equally, the volume of research will be lower, types of research may be more varied, and only a proportion of the research activity may be focussed on issues specific to the priorities of general practice. There is an evidence base linking research activity in general practice to performance, but it is less extensive.[13–15] Assessing the relationship in general practice is important, as the bulk of patient contacts are in this setting, and any benefits of research activity on general practice performance would be potentially widespread.

Nonetheless, if these associations exist in both hospital and general practice settings, we cannot assume that research activity is causing better outcomes - relationships between research activity and practice performance in cross-sectional analyses may be due to other factors, such as characteristics of practices or the patients they serve. Research activity is not routinely amenable to experimentation, meaning that statistical modelling of causal relationships is required.

Aims

We sought to replicate existing evidence from hospital studies and (a) test whether there were significant relationships between research activity in general practice and organisational performance (b) test whether those relationships were plausibly causal.

Methods

Data Sources

Measures of research activity

The NIHR CRN is divided into 15 local regions (https://local.nihr.ac.uk/lcrn/) and provides national research activity data at a practice-level on (a) number of patients recruited by each general practice (b) the number of studies involving the practice. We supplemented this with a second measure provided by the Royal College of General Practitioners, as to whether practices were signed up to their 'Research Ready' programme, which provides information and guidance to practices to support research activity. We categorised practices as (a) current members of the 'Research Ready' programme (b) previous members (c) practices that had never participated.

Measures of practice performance

We developed a logic model to support our analyses which detailed measures, mechanisms, outcomes, and wider impacts on practice performance, and which was developed with our expert advisors and patient contributors (Appendix 1). We used a range of measures of practice performance based on routine data, which captured several aspects of general practice performance and included more immediate impacts (such as patient experience) as well as those further down the causal pathway in our logic model (e.g. hospital utilisation).

- *Clinical quality of care* - From the Quality and Outcomes Framework (QOF), we obtained data on points achieved in the clinical domains as a marker of the technical quality of care. As the number of points achievable changes annually, we used the percentage of points achieved in a particular year.
- *Prescribing quality* – from the OpenPrescribing database, we created a measure of the proportion of antibiotics issued that were narrow-spectrum antibiotics, a recognised marker of quality of general practice prescribing.[16 17]
- *Patient experience* – General Practice Patient Survey (GPPS) is an independently-administered survey measuring patient experience of various aspects of general practice.[18] We used data on how respondents (a) reported their overall experience with the practice and (b) satisfaction with making an appointment. We analysed the percentage of patients that reported 'very good' or 'fairly good' experience.
- *Hospital utilisation* – Hospital Episode Statistics (HES) has data about use of hospitals in England. We obtained counts of admissions (non-elective), outpatient attendances (first attendances only, attended appointments only), Accident & Emergency (A&E) attendances and ambulatory case sensitive conditions (ACSC) in 2017.
- *GP satisfaction and retention* – the National GP Worklife Surveys measure GPs' experiences of their working lives. From the 2019 survey we obtained satisfaction data and linked this to the practice. This could only be used in the cross-sectional analyses due to differences in sampled GPs between years. We also calculated the percentage of GPs who remain at each practice from one year to the next.[19]

We also included the following covariates: list size; full time equivalent (FTE) GPs, nurses, other direct patient care and administrative staff; percentage of salaried GPs; local research network region; patient age and gender distribution; income deprivation (in 2019); contract type; practice training status; market

forces factor (a measure of wages in the local labour market); and population need (ratio of weighted to unweighted patients).

Statistical analyses

We initially used cross-sectional analyses to explore relationships between cumulative research activity and practice outcomes. This was primarily to allow comparison with the wider literature using similar cross-sectional methods. We used linear regression to relate practice performance to measures of research activity. For the cross-sectional analysis, for CRN data we summed the number of patients and studies across the period for which data were available (2008–2019 in some cases, with lesser periods with some analyses). The 'Research Ready' measure is a binary indicator. Performance measures were standardised using z-score transformations to aid comparisons. The estimated effects of research were summarised by calculating a unit change in research (e.g. an additional patient or study), holding other characteristics constant (median values for continuous variables, means for discrete variables). Huber–White robust standard errors were utilised to allow for heteroscedasticity.

The main analyses used panel models to explore relationships between annual research activity and practice performance in the following year. These analyses avoid reverse causality (as changes in research activity have to occur before practice outcomes) and control for unmeasured factors that are stable or relatively stable over time (such as practice research culture). We examined the impact of research activity in a particular year on the outcome in the following year using a fixed effects regression model. We also estimated regressions using three year lags. The 'Research Ready' measure did not vary over time and was excluded from the panel analyses.

$$Y_{it} = \beta_1 X1_{it} + .. + \beta_k Xk_{it} + \beta Res_{it-1} + \alpha_i + u_{it}$$

1

With i = 1,…n and t = 1 ..T. The α_i are the practice-specific intercepts that capture between-practice heterogeneity. Res_{it-1} is the research activity for practice i in time t-1.

Panel models control for reverse causality and unmeasured factors that do not change over time but concerns about confounding remain if the practices that become research active also take other unmeasured actions at the same time to improve outcomes. To address this, we used an instrumental variable approach. An instrumental variable should be related to research activity (inclusion condition) and not otherwise impact on the outcomes directly (exclusion restriction). We used as an instrument a measure of the amount of research activity in the local area (defined as the 15 local research networks covering England), as a measure of the research opportunities available to the practice. A practice that is located in a high-activity area is potentially more likely to participate, relative to a practice located in a low-activity location, but wider research activity outside the practice is unlikely to impact on the performance of a specific general practice. To account for differences in the size of the local research area we divided the total activity by the number of patients in the region. We therefore use i) the number of patients recruited into general practice research (per patient) in the local research network area, and the

same for secondary care research. As with the cross-sectional results, all outcome scores were standardised using z-score transformations to aid comparisons. Untransformed mean and standard deviation statistics for the outcomes are also provided. We assessed the instrument using conventional tests (see Appendix 2).

Study reporting conformed to the STROBE statement (see attached checklist).

Patient and public involvement

Patients and the public contributed in groups attached to three institutions (Manchester, London and Cambridge) and as part of the Advisory group. For the analyses presented here, patient contributors advised on the development of the logic model and assisted in the interpretation and dissemination of the analyses through Plain English Summaries.

Ethics Statement

All analyses used anonymised data linked to practices and did not require formal ethical approval.

Results

Participating general practices

CRN research activity data were available for 7,921 practices, of which 1,465 (18.5%) were dropped due to having no 2019 workforce data (indicating that they were no longer operating). We excluded a further 112 (1.7%) practices due to list sizes < 1000 (sub-practices, those attached to universities, and those closing down) and 141 (1.8%) as data on practice characteristics were unavailable. Descriptive statistics are presented in Tables 1. Levels of research activity were generally low with high variation. Many practices scored highly on the outcomes used, especially clinical quality and overall satisfaction.

Table 1
Descriptive statistics (research activity and outcomes)

	All practices (Outcomes – 2019)				
	Mean	Std. Dev.	Min	Max	N
Patients Recruited 08–19	133	322	0.00	4602	6770
Patients Recruited 15–19	63	199	0.00	3567	6770
Studies 08–19	6.6	9.2	0.00	92	6770
Studies 15–19	3.9	6.1	0.00	60	6770
Research Ready - Never	0.76	0.43	0.00	1.00	6770
Research Ready - Expired	0.21	0.41	0.00	1.00	6770
Research Ready - Current	0.04	0.19	0.00	1.00	6770
QOF Achievement (%)	95.6	5.8	30.8	100	6689
GP Retention Rate (%)	92.5	13.0	0.00	100	6591
Patient Satisfaction Overall (%)	83.5	9.8	32.2	100	6761
Patient Satisfaction Appointment (%)	69.5	14.5	19.1	100	6761
Narrow Antibiotic to Total (%)	96.0	1.7	86.4	100	6770
Practice list size (thousands)	8.86	5.8	1.02	84.66	6770
Patients over 65 (%)	17.5	7.0	0.01	49.4	6770
Patients female (%)	49.8	2.3	15.6	61.1	6770
Practice GP Workforce (FTE)	5.0	3.7	0.00	40.1	6722
Practice Nurse Workforce (FTE)	2.4	2.3	0.00	32.1	6616
Practice DPC Workforce (FTE)	1.8	2.3	0.00	37.1	6464
Practice Admin Workforce (FTE)	10.0	7.6	0.00	106.7	6763
Salaried GPs (%)	24.3	25.0	0.00	100.00	6684
Rural Practice (1 = yes)	0.16	0.4	0.00	1.00	6764
GMS Practice (1 = yes)	0.71	0.5	0.00	1.00	6764
Dispensing Practice (1 = yes)	0.16	0.4	0.00	1.00	6764
Population need	1.01	0.1	0.56	1.52	6760
Market Forces Factor	1.00	0.0	0.93	1.13	6764

	All practices (Outcomes – 2019)				
Income Deprivation	0.14	0.1	0.02	0.44	6770

Are there associations between research activity and organisational performance?

Cross sectional associations between research activity and outcomes are shown in Table 2. The marginal effects are presented as beta coefficients and are interpreted as the association between a unit change in research activity and beta standard deviation change in the outcome. All measures of research activity showed a significant, positive association with clinical quality and a negative association with A&E attendances. The magnitude of these associations was small. For example, each additional research study (between 2008–2019) was associated with a 0.004 standard deviation increase in QOF achievement.

Table 2
Standardised cross-sectional regression models

	Mean (SD)	Obs	Patients (100s) beta (95% CI)	P	Studies beta (95% CI)	P	Research Ready beta (95% CI)	P
Primary care outcome variables								
QOF Achievement (%)	95.8 (5.3)	6045	0.0079 (0.0020 to 0.0137)	0.0087	0.003 (0.001 to 0.006)	0.006	0.155 (0.061 to 0.249)	0.001
Antibiotic Ratio	96.0 (1.7)	6062	-0.0043 (-0.0102 to 0.0016)	0.1503	-0.002 (-0.004 to 0.000)	0.081	-0.065 (-0.176 to 0.046)	0.248
Patient Satisfaction Overall (%)	83.8 (9.6)	6061	0.0050 (-0.0021 to 0.0121)	0.1703	0.005 (0.002 to 0.007)	< 0.000	0.190 (0.088 to 0.291)	< 0.000
Patient Satisfaction Access (%)	69.6 (14.5)	6061	0.0037 (-0.0034 to 0.0109)	0.3073	0.004 (0.002 to 0.007)	0.002	0.186 (0.069 to 0.304)	0.002
GP Satisfaction	4.5 (1.6)	1045	0.0072 (-0.0066 to 0.0211)	0.3076	0.003 (-0.002 to 0.008)	0.274	-0.078 (-0.349 to 0.192)	0.570
GP Retention Rate	92.6 (12.3)	5981	0.0025 (-0.0043 to 0.0093)	0.4744	-0.001 (-0.003 to 0.002)	0.592	0.050 (-0.070 to 0.170)	0.414
Secondary care outcome variables								
ACSC (per 1000)	18.6 (5.6)	6080	-0.009 (-0.016 to -0.002)	0.008	-0.006 (-0.009 to -0.003)	< 0.000	0.007 (-0.098 to 0.112)	0.893
A&E Attendances (per 1000)	260.3 (83.8)	6080	-0.010 (-0.016 to -0.003)	0.003	-0.005 (-0.008 to -0.003)	< 0.000	-0.106 (-0.193 to -0.020)	0.016
Emergency Admissions (per 1000)	97.3 (25.4)	6080	-0.002 (-0.009 to 0.004)	0.504	-0.003 (-0.005 to -0.000)	0.029	-0.011 (-0.110 to 0.089)	0.836

	Mean (SD)	Obs	Patients (100s) beta (95% CI)	P	Studies beta (95% CI)	P	Research Ready beta (95% CI)	P
Outpatient Attendances (per 1000)	1579.3 (391.3)	6080	-0.008 (-0.015 to -0.001)	0.036	-0.005 (-0.008 to -0.002)	0.001	-0.032 (-0.146 to 0.083)	0.589

Are associations between research activity and organisational performance causal?

The marginal effects for the fixed effects panel models are shown in Table 3. Unlike the cross-sectional analyses, panel models showed far fewer significant relationships between research activity and practice performance in subsequent years, and only in relation to research activity as measured by number of research studies. Instrumental variable analyses (Table 4) showed a mixed pattern of results. Patient recruitment was related to higher overall patient satisfaction, lower A&E and outpatient attendances, and higher use of emergency admissions. Numbers of studies were related to lower A&E and outpatient use. Only the association between numbers of studies and lower A&E use was significant and passed all three post estimation tests of the quality of the instrument (Appendix 2).

Table 3
Panel regression models

	Mean (SD)	Obs	Patients beta (95% CI)	P	Studies beta (95% CI)	P
Primary care outcome variables						
QOF Achievement (%)	96.3 (5.9)	24955	-0.001 (-0.011 to 0.010)	0.882	0.007 (-0.015 to 0.001)	0.076
Antibiotic ratio	95.8 (1.8)	25158	0.002 (-0.010 to 0.015)	0.718	0.005 (-0.001 to 0.012)	0.111
Patient satisfaction overall (%)	84.8 (9.5)	25104	0.003 (-0.011 to 0.016)	0.719	0.004 (-0.003 to 0.011)	0.284
Patient satisfaction access (%)	72.5 (14.2)	25101	-0.004 (-0.016 to 0.008)	0.521	0.004 (-0.003 to 0.011)	0.245
GP retention rate	92.5 (13.2)	24990	-0.007 (-0.027 to 0.014)	0.516	-0.004 (-0.015 to 0.008)	0.530
Secondary care outcome variables						
ACSC (per 1000)	18.5 (6.3)	12876	-0.006 (-0.022 to 0.011)	0.494	0.012 (0.002 to 0.022)	0.020
A&E attendances (per 1000)	262.9 (96.5)	12876	-0.003 (-0.017 to 0.012)	0.719	-0.008 (-0.014 to -0.001)	0.018
Emergency admissions (per 1000)	96.6 (31.8)	12876	-0.009 (-0.023 to 0.005)	0.205	0.004 (-0.003 to 0.011)	0.262
Outpatient attendances (per 1000)	1593.8 (487.1)	12876	0.000 (-0.005 to 0.006)	0.888	-0.004 (-0.009 to 0.001)	0.087

Table 4
Instrumental variable models

	Mean (SD)	Obs	Patients IV beta (95% CI)	P	Studies IV beta (95% CI)	P
Primary care outcome variables						
QOF achievement (%)	96.28 (5.86)	24955	-0.045 (0.234 to 0.144)	0.642	-0.015 (-0.095 to 0.065)	0.707
Antibiotic ratio	95.80 (1.76)	25158	0.126 (0.034 to 0.285)	0.123	0.062 (-0.011 to 0.135)	0.095
Patient satisfaction overall (%)	84.77 (9.49)	25104	0.183 (0.014 to 0.351)	0.034	0.017 (-0.046 to 0.081)	0.592
Patient satisfaction access (%)	72.52 (14.18)	25101	0.083 (0.063 to 0.229)	0.263	0.074 (-0.010 to 0.158)	0.083
GP retention rate	92.47 (13.23)	24990	0.277 (0.036 to 0.589)	0.083	0.109 (-0.025 to 0.242)	0.111
Secondary care outcome variables						
ACSC (per 1000)	18.52 (6.26)	12876	-0.086 (0.297 to 0.125)	0.424	-0.062 (-0.198 to 0.074)	0.375
A&E attendances (per 1000)	262.89 (96.49)	12876	-0.371 (-0.558 to -0.183)	< 0.000	-0.280 (-0.404 to -0.155)	< 0.000
Emergency admissions (per 1000)	96.57 (31.75)	12876	0.160 (0.001 to 0.320)	0.049	0.040 (-0.055 to 0.134)	0.414
Outpatient attendances (per 1000)	1593.82 (487.06)	12876	-0.320 (-0.461 to -0.178)	< 0.000	-0.179 (-0.261 to -0.097)	< 0.000

Discussion

Statement of principal findings

We used national longitudinal data on research activity and general practice performance to demonstrate that in line with the wider hospital literature, research activity was associated with a number of practice performance measures, including quality of clinical care, patient experience and hospital utilisation. However, our analyses did not suggest those relationships were causal, with the results from the panel and instrumental variable analyses inconsistent in both magnitude and direction. Given such a pattern of results, our results did not support a strong message about causal impacts of research activity.

Strengths and weaknesses of the study

Our analyses were comprehensive in terms of the population of practices and access to data on their characteristics. Nevertheless, there were limitations. Practices may engage in research activity not

captured by CRN data. This may involve identification of patients for hospital studies where there is no consent in primary care. Others engage in database projects like the Clinical Practice Research Datalink or ORCHID, which may involve data quality initiatives, but where the involvement of practitioners in such activities may be far less than conventional patient-oriented research. There may be wider activities such as audit and service evaluation which are not formally captured as research but may involve similar processes and may be important markers of better care. Although we had access to a number of measures of performance that have been widely used in other research, these were routine measures, and were not chosen on the basis of their links to the types of research being undertaken. There will be a direct contribution of research activity in individual practices to the combined research activity in the area, which will generate a modest degree of endogeneity in the instrumental variable. In addition, regional organisations may undertake quality improvement activities as well as encouraging research participation. This would invalidate the instrumental variable, but is unlikely given the disparate organisations involved. Finally, the analyses pre-dated the pandemic and may not capture benefits of large-scale engagement in COVID studies.

Strengths and weaknesses in relation to other studies

Our study is one of the largest assessments of the link between research activity and outcomes, certainly compared to previous studies in general practice.[13–15] We also included multiple measures of research activity and outcomes and used analytic methods to explore causal relationships.

As noted previously, the lack of effects in the panel analyses may not reflect the general practice context specifically, as most existing analyses in hospitals are cross-sectional.[10] Nevertheless, there are some features of research activity in general practice that might make it difficult to demonstrate any impacts of research activity on performance. First, the 'dose' of research activity in general practice is low – the mean annual patients recruited 2015-19 was 11. In one of the most cited papers linking hospital research to outcomes,[9] the hospitals showing the biggest impacts on outcomes were those reporting 25% of patients with colorectal cancer engaged in research, which represents a qualitatively different level of activity. Additionally, the hospital study had a very focussed scope, involved a single speciality with a high number of interventional trials which had the aim of changing clinical practice and impacting on a defined outcome (mortality) – possibly the optimal conditions in which to find strong relationships between research activity and performance. In contrast, general practice research may involve a far wider range of research studies on a diverse number of topics, with only a small minority specifically related to the clinical areas (e.g. prescribing) captured in our outcomes. For example, some of the top recruiting studies in primary care (2018–2019) included studies of improved check-in facilities, vascular genetics and diagnostic testing in Barrett's oesophagus.

Meaning of the study: possible mechanisms and implications for clinicians or policymakers

There is interest in increasing research activity to better serve the needs of the NHS, and the idea that such increases would also lead to 'spill-over' benefits in practices is an attractive one. Our results suggest

that research activity remains a useful indicator of a high performing general practice. Importantly, patient contributors involved in our study raised some concerns that general practice research activity could potentially distract from clinical responsibilities. Such effects would be important in the context of the current debate about access to general practice care. However, we found no evidence that research activity was associated with any reductions in performance (such as patient experience of access to care).

Levels of research activity in general practice are relatively low and highly variable, and the case for greater investment in primary care research remains strong,[20 21] even in the context of the current findings. It is possible that higher levels of research activity than those seen here are associated with more significant impacts. This may be more likely if research activity is augmented with additional facilitation that could maximise spill-over benefits (such as providing practices with more feedback, or more time to reflect on the implications of research), or if research activity involves types of research which may be better able to generate wider benefits.[13] Exploring such mechanisms is an important future research issue.

In summary, our analyses suggest that increasing research activity may not be reliable way of improving general practice performance. Nevertheless, research activity is a useful indicator of a high performing practice and has no demonstrable disadvantages.

Declarations

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