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A case study of eight Partnership for Older People Projects (POPP)

# An evaluation of the impact of community-based interventions on hospital use

*Research summary*

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## Acknowledgements

We are grateful for the assistance of staff in the eight POPP sites for supplying the data analysed in this study. We would also like to acknowledge the invaluable assistance we received from the NHS Information Centre for Health and Social Care, and from Northgate Information Solutions. Finally, we would like to thank Richard Grieve and Roland Ramsahai from the London School of Hygiene and Tropical Medicine for their advice, and our colleagues Jennifer Dixon, Ian Blunt and Ludovic Chassin at the Nuffield Trust for their support and guidance.

In recent years, the Department of Health has encouraged efforts to deliver more care in community settings, with the joint aims of avoiding unplanned admissions to hospital and reducing net costs. Interventions that prevent such admissions can, in theory, both improve the quality of care delivered and help address the financial challenges currently faced by the NHS. This research summary outlines the findings of an evaluation conducted by researchers at the Nuffield Trust that examined whether eight such interventions achieved a reduction in hospital use. The evaluation was conducted using a person-based, risk-adjusted approach.

## Key points

- We examined eight carefully selected interventions that formed part of the wider Partnership for Older People Projects (POPP) initiative, funded by the Department of Health. Of these, four were thought to have a high likelihood of reducing hospital admissions.
- In the absence of a randomised controlled trial, we compared participants to matched controls. Our research method ensured that participants and controls were similar in terms of a very wide range of characteristics. However, it is possible that our findings could be driven by other, unknown differences between the groups that we were unable to observe.
- When compared to matched control patients, we did not find evidence of a reduction in emergency hospital admissions associated with any of the POPP interventions studied. In some instances, there were more admissions in the intervention group than in the control group. One intervention reduced the number of bed-days, but overall we found that the interventions we studied did not appear to be associated with a reduction in the use of acute hospitals.
- One possible explanation for our findings is that the process of 'case finding' identified unmet need. In other words, when patients first entered into the interventions, the professionals may have identified problems that necessitated hospital admission.
- The impact of hospital-avoidance interventions should be monitored in as close to real-time as possible. If they are not effective, it might be possible to refine the intervention or connected services in order to improve its effectiveness.
- NHS commissioners should consider using person-based risk-adjusted evaluation (PBRE) to test whether preventive care interventions are effectively avoiding hospital admissions. The impact on the NHS of local authority interventions can also be evaluated using NHS datasets in this way.
- The evaluation approach we developed using matched control groups is novel and has several advantages over traditional methods. The approach is relatively inexpensive due to the use of existing data sources, and predictive modelling controls for the natural tendency that some patients have fewer admissions over time.
- The potential to improve the quality of care while reducing net 'downstream' costs is substantial. Further innovation is therefore essential, both in terms of refining the case finding process and in the design of interventions.

## Background

The costs associated with complex health and social care needs in the UK are expected to rise considerably over the coming years. This is largely due to two linked phenomena: an ageing population and the increasing number of people who will be living with long-term medical conditions.[1]

In an effort to improve the quality of care, while at the same time addressing the financial strain on the NHS and local authorities, efforts are being made across the UK to deliver more health and social care in community settings.[2] A critical marker of success is the prevention of unplanned admissions to hospital.

Emergency hospital admissions are undesirable for the individual patient concerned and are expensive to the NHS, costing over £1,000 per admission, on average.* However, it is commonly accepted that many unplanned admissions can be prevented if the optimal care is in place. Currently, many patients with chronic diseases, such as heart failure and chronic obstructive pulmonary disease (COPD), face a rapid succession of hospital admissions.

One recent initiative to address this issue was the Partnership for Older People Projects (POPP). These were a series of innovative projects that received ring-fenced funding from the Department of Health over a two-year period (some ran from 2006 to 2008, and some from 2007 to 2009). They were led by local authorities, in partnership with their local primary care trusts and representatives from the voluntary, community and independent sectors. Their aim was to *"shift resources and culture away from institutional and hospital-based crisis care for older people towards earlier, targeted interventions within their own homes and communities."* [3]

Under the POPP initiative, 29 projects were funded, which between them operated a total of 146 core interventions. The Department of Health subsequently commissioned the Nuffield Trust to evaluate a small but carefully selected set of eight POPP interventions. We were asked to examine in detail whether these interventions were successful in avoiding emergency admissions to hospital.

Four of the eight POPP interventions were selected because there was felt to be a strong possibility of an impact on hospital admissions. These were:

- a programme of support workers who worked alongside community matrons with people with long-term conditions
- an intermediate care scheme supporting people on discharge from hospital
- multi-dimensional integrated health and social care teams
- daytime and out-of-hours response services.

The other four POPP interventions were short-term assessment and signposting services, which aimed to improve access to existing low-level preventive services (Table 1, E–H). There was little expectation that these would produce clear evidence of an impact on hospital use, but they were included speculatively in case this new approach to evaluation might detect some effects that might elude other more traditional approaches.

*Nuffield Trust calculation of the median tariff for an emergency inpatient admission in 2008/09 under Payment by Results.

| Table 1: The eight POPP interventions examined in this study | |
|---|---|
| A | Support workers working under the direction of community matrons with people with one or more long-term conditions who were felt to be at risk of deterioration or were unstable. Support workers provided personal nursing and social care. |
| B | Intermediate care service with generic workers, which supported people on discharge from hospital. |
| C | Integrated health and social care teams configured around primary care teams, which focused on people with one or more long-term conditions. |
| D | Out-of-hours response service and daytime response service, both consisting of an integrated team comprising community alarm services, mobile wardens, generic workers, district nurses, paramedics and community psychiatric nurses. |
| E | Volunteer-run assessment and signposting service. Volunteers made contact with older people, carried out a home-based 'check-up', and provided advice on benefits entitlement, housing, community transport, education and leisure activities. If necessary, the volunteer acted as a personal navigator through the range of services available. |
| F | Short-term assessment and signposting service, which targeted older people living in the most deprived areas. A multi-agency team signposted a range of services, including health, housing, social care, benefits and community development. |
| G | Short-term assessment and signposting service, which involved staff visiting clients in their own environment. This initiative used the single assessment process to signpost and commission from a pre-agreed menu of community services, or referred clients to specialist services. |
| H | Short-term assessment and signposting service which aimed to improve access to low-level preventive services by establishing a single point of access. Joint prevention teams consisted of health advisers, health trainers, social care workers, link workers, a team coordinator and volunteers. |

## Evaluation approach

The POPP initiative as a whole has been subject to a national evaluation which concluded that the programme had improved users' quality of life, with the size of the improvement varying according to the nature of the individual projects.[4] It also estimated that, for every £1 spent on the programme, there was approximately a £1.20 additional benefit due to savings on emergency hospital bed-days.

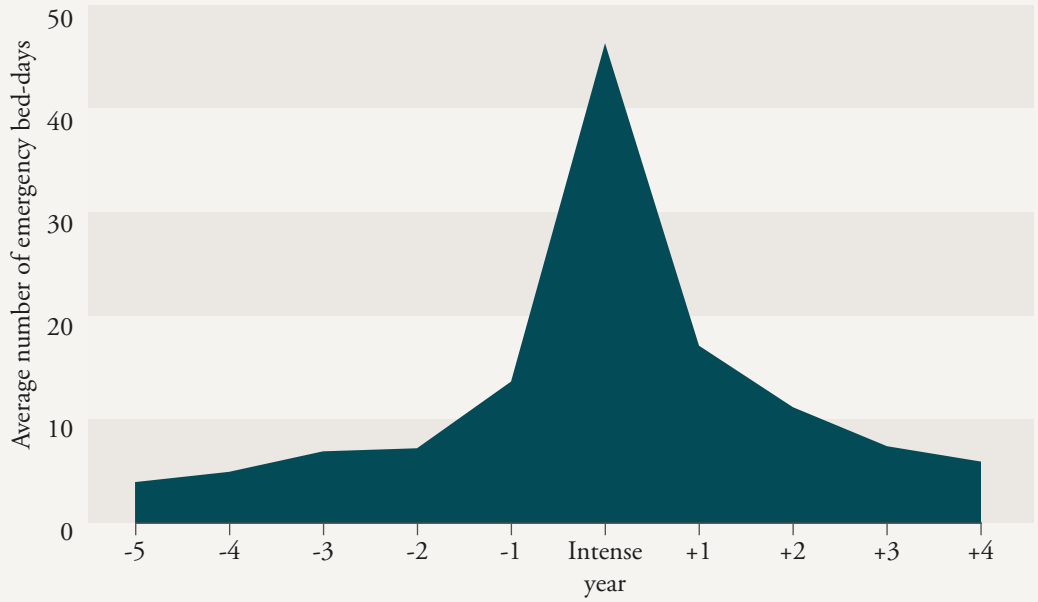
Compared to the national evaluation, the current study had a narrower focus, considering the impact of eight specific interventions, out of the 146 offered under POPP, and examining only the effects on hospital use. This narrow focus enabled us to adopt new and sophisticated person-based approaches.

New data linkage techniques developed with the NHS Information Centre allowed us to obtain person-level data about hospital activity without compromising confidentiality. The eight POPP sites under evaluation were asked to send identifiable data about the people who had received the intervention to the NHS Information Centre, who then linked this information to the Hospital Episode Statistics (HES). Analysts at the NHS Information Centre then sent a pseudonymous HES dataset to the evaluation team at the Nuffield Trust, which included person-level information but non-identifiable data about the hospital activity and medical diagnoses of the people who had received the intervention.

This meant that we could examine the patterns of hospital use of the individuals who received the POPP interventions, rather than relying on aggregated data for their entire primary care trust area. This was important because patterns of hospital use can vary considerably within any geographical area, due to both local factors and wider effects such as national policy. Some of the POPP interventions were targeted on relatively small numbers of individuals; by studying person-level data rather than area data, we were able to focus more precisely on the individuals who received the intervention. If we had used area data, we might have detected changes in hospital admission patterns due to other factors or other patients, and falsely attributed these to the particular intervention under study (the so-called 'ecological fallacy').

We were able to identify a control group at person level from other, similar areas of the country. Although the POPP initiative was not designed to be evaluated as a randomised control trial, we were able to select controls from national datasets in ways that helped ensure they were very similar to the people who actually received the POPP interventions. This was particularly important in this evaluation because some of the interventions were targeted according to people's history of hospital admissions. People who have had many recent hospital admissions have a natural tendency to experience fewer admissions in the future, even without an intervention, due to a statistical phenomenon called 'regression to the mean'. Without a robust control group, the evaluation of hospital avoidance interventions can be misleading, since it may simply reflect regression to the mean (see Figure 1).

## Figure 1: Regression to the mean in the absence of a specific intervention




Source: Department of Health analysis of Hospital Episode Statistics for England

Regression to the mean is illustrated in Figure 1, which spans a ten-year period and illustrates hospital admissions for a cohort of frequent hospital users who were identified in the central, intense year. Hospital admissions were tracked for this cohort of people for five years beforehand and five years afterwards. The figure shows that, if patients are chosen for an intervention based on their current high rates of hospital admissions, we would expect their rates of hospital admissions to reduce over time, even in the absence of a specific intervention. This would mean that an evaluation without an appropriate control group would tend to overestimate the effectiveness of the intervention on hospital use, since some or all of the observed reductions would have happened anyway.

## Selection of control groups

There are many ways to select control groups. Often evaluations use simple standardisation for age and sex. In our study, however, we aimed to select much more closely matched controls. For each individual who received the intervention we selected one control who was matched for as many of the following criteria as possible at the moment the intervention began:

- The predicted risk of experiencing an emergency hospital admission in the next 12 months. Our predictive risk model was a version of the Patients At Risk of Re-hospitalisation (PARR) model recalibrated to each individual POPP site. PARR is used widely by the NHS for case finding purposes.
- A set of 15 markers of health conditions, including diabetes, congestive heart failure, COPD, cancer, a history of falls and mental health conditions.
- History of hospital utilisation, including number of emergency and elective inpatient admissions over different time frames, number of outpatient attendances, and prior length of hospital stay.
- Age, sex and area-level deprivation score.

**5,146**

**participants across the eight POPP interventions studied**

Overall, 84 per cent of participants identified by the eight sites could be linked to hospital data. Of these people, we focused our analysis on a subset of individual participants who did not form part of the very first cohort to receive the intervention, and for whom we had sufficient follow-up data. Further, we chose to focus on those participants who had experienced a hospital admission during the two years before the start of the intervention. This was for two reasons:

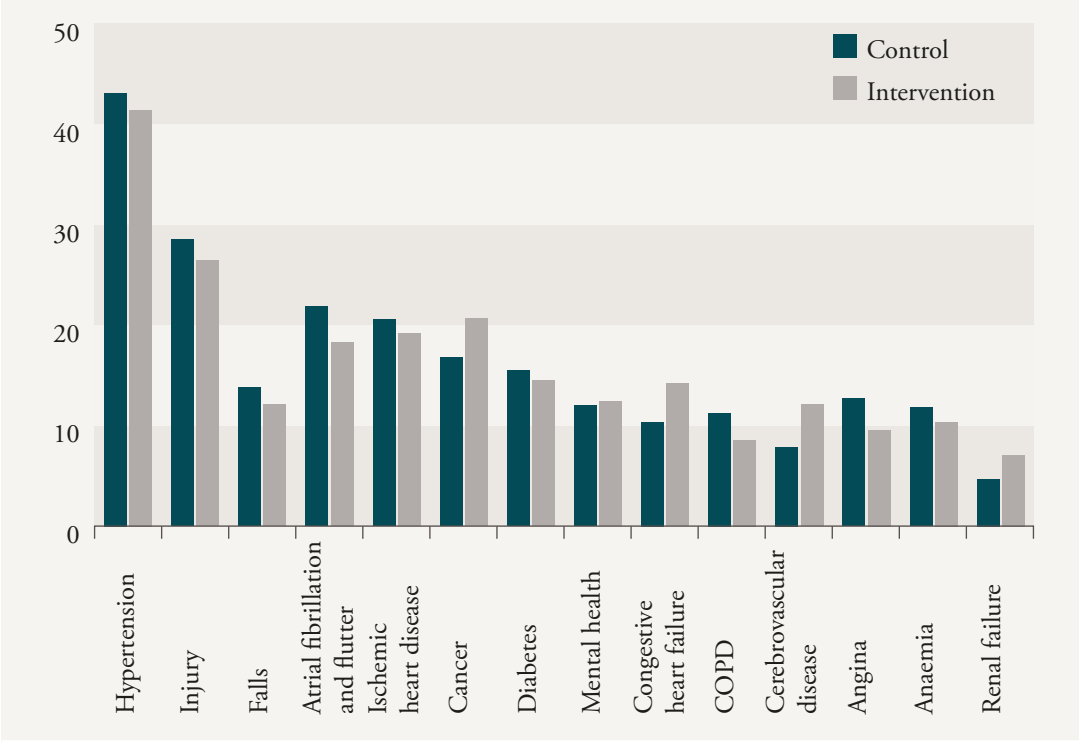
- There is very limited scope to prevent hospital admissions in the short term for people who have not recently had a hospital admission. For example, fewer than five per cent of 65-year-olds who have not had a hospital admission in the last two years will have an admission in the next 12 months. By focusing on people with a history of hospital admissions, we were concentrating our analysis on those patients most likely to benefit from the intervention in the short term.
- More information is available about people who have recently had a hospital admission, since medical diagnoses are routinely recorded within HES. We therefore concentrated our analysis on these people to ensure that our control group selection was more robust.

After applying these restrictions, we were left with a group of 5,146 participants across the eight POPP interventions studied. This represented just under half (47 per cent) of the total number of people who received these interventions, but it was the half for whom the interventions were most likely to have an effect on in the short term. An accompanying technical report is available on the Nuffield Trust website[5], which describes the performance of the data linkage and the numbers of records used in each stage of the analysis in more detail, for each site.

Controls were selected at a person level from other similar areas of the country (detailed diagnostic information about the quality of the matches is available in the technical report[5]). However, as an example, for one of the interventions studied we found that:

- in both the control group and the intervention group, 55 per cent of individuals were aged over 85
- the control group had a mean area-level deprivation score of 17.7, compared with 18.1 for the intervention group
- the control group had an average of 1.1 emergency hospital admissions per head in the 12 months before the start of the intervention, compared with 1.0 for the intervention group
- the prevalence of health diagnoses was similar for the two groups (see Figure 2).

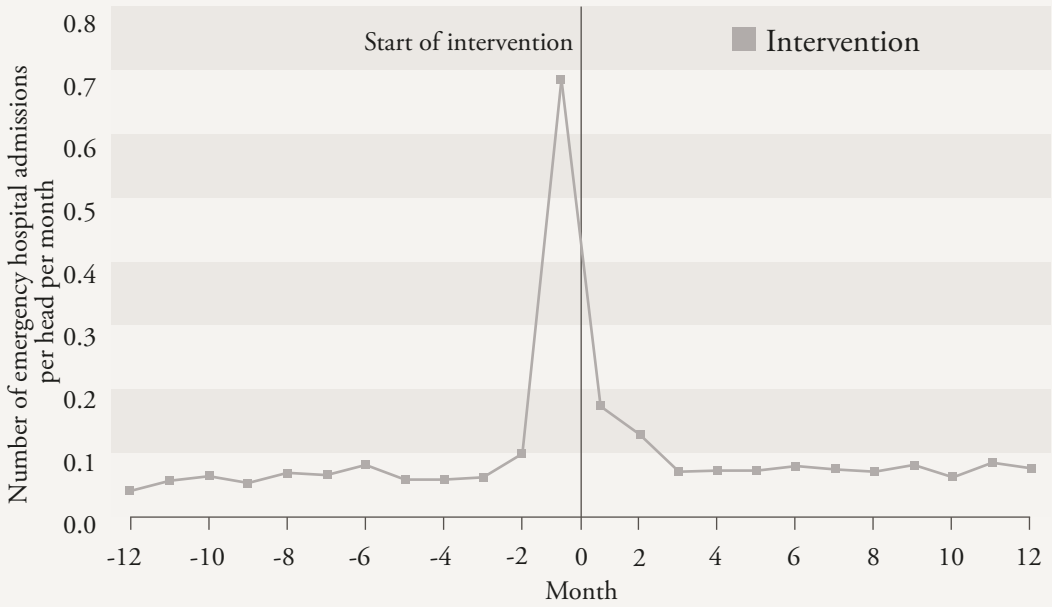
Figure 2: Prevalence of health diagnosis categories in intervention and control groups (intervention D)




## The effect of the interventions on emergency hospital admissions

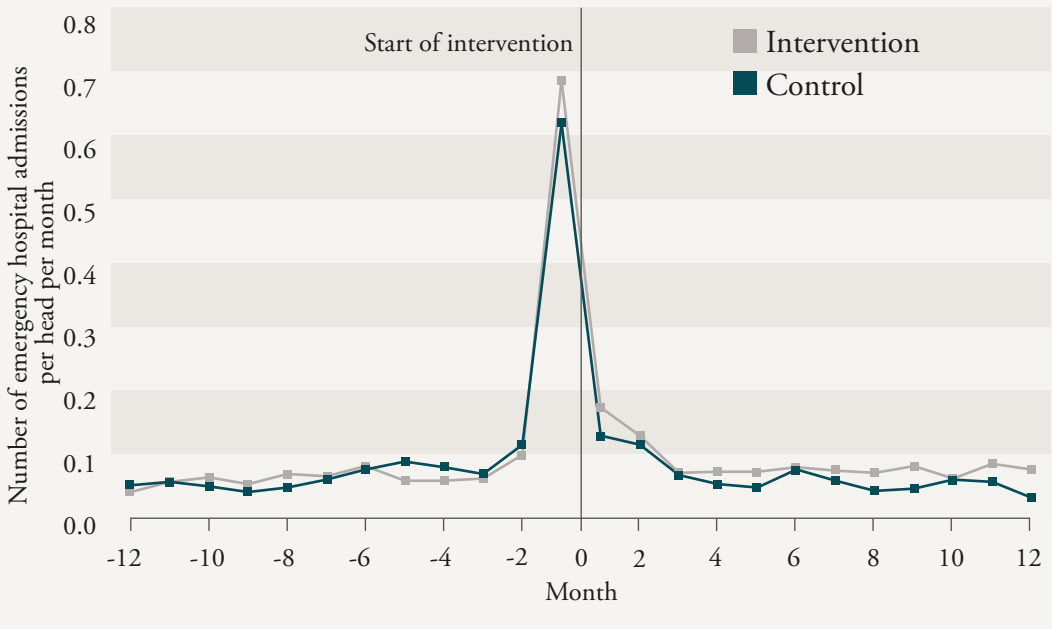
A simple pre-post comparison of the rate of emergency hospital admissions before and after the intervention would have been misleading. Such an evaluation would have suggested a reduction in admission rates for four of the eight interventions studied (A, B, C and H). For example, the people receiving the intermediate care service (B) experienced 1.42 emergency admissions per person in the 12 months before the start of the intervention, compared with only 1.06 in the 12 months afterwards (Figure 3). The problem with this type of evaluation is that there was a clear peak in hospital admissions just before the start of the intervention, which suggests that the group might be expected to experience a regression to the mean. To avoid this problem and to understand the true impact of the intervention, a control, or 'counterfactual', is needed to estimate what would have happened to the intervention group in the absence of the intervention.

## Figure 3: Intermediate care service (intervention B)




As can be seen in Figure 4, the control group experienced a similar pattern of admissions to the intervention group in the 12 months before the start of the intervention. This is intentional because prior hospital use was one of the factors that determined our choice of controls. Following the start of the intervention, the number of hospital admissions experienced by the control group dropped off rapidly; in fact even more rapidly than for the intervention group. This suggests that intervention B led to an *increase* in the number of admissions for the intervention group, of around 0.64 extra admissions per head over a 12-month period.

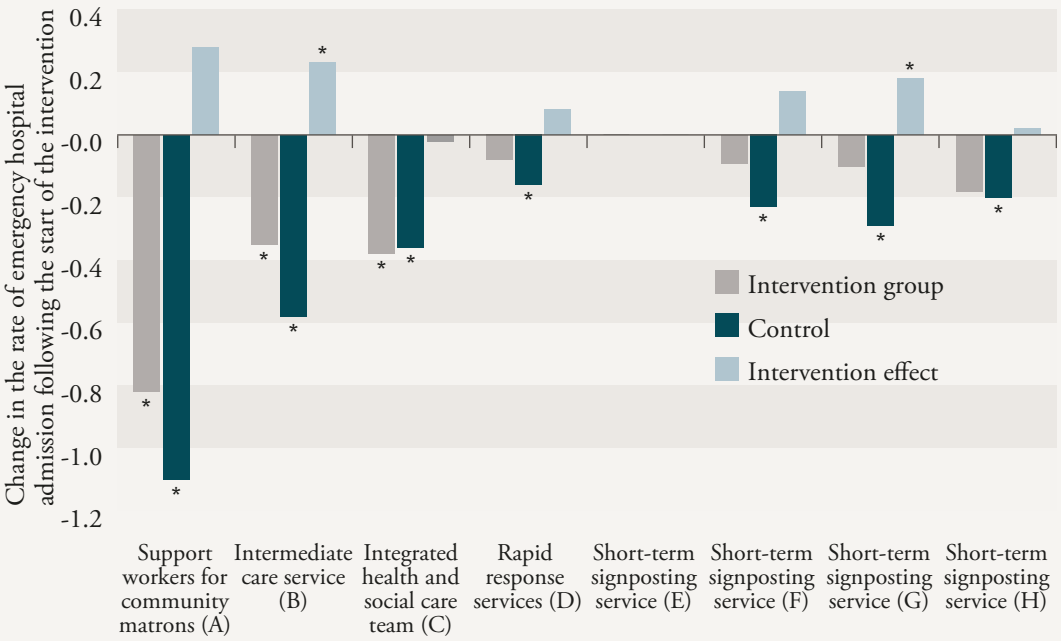
## Figure 4: Intermediate care service (intervention B)



It was not possible to track hospital admissions over a full 12 months for four of the interventions. However, we found that none of the eight interventions led to overall reductions in emergency hospital admissions (Figure 5). We conducted similar analyses for the number of bed-days following emergency admission, the number of elective hospital admissions, and the number of outpatient attendances. In summary we found that:

- The support workers for community matrons seemed to have no impact on hospital use (intervention A).
- The intermediate care scheme with generic workers increased the number of emergency admissions and bed-days following emergency admissions, but it reduced the number of outpatient attendances (B).
- The health and social care teams reduced the number of bed-days following emergency admissions, reduced elective admissions and reduced outpatient attendances (C). This intervention seemed also to reduce emergency admissions for a particular high-risk subgroup that had high predictive risk scores.
- The rapid response service reduced outpatient attendances (D).
- One of the short-term assessment and signposting services increased the number of emergency hospital admissions (G), while another increased the number of outpatient attendances (E).

## Figure 5: Changes in hospital admission rates for interventions studied




*denotes statistically significant at the 5% level.

Note: Admissions rates are for 12 months before/after the intervention for A, B, F and G; six months before/after the intervention for C, D and H; and nine months before/after the intervention for E.

We compared the proportion of intervention and control group members who died in the period following the intervention, but unfortunately we were only provided with data about deaths that occurred in hospital. We found a higher death rate among the intervention group than the control group for three of the interventions (B, C and D). Potential explanations include poor matching at these three sites, or differences in the proportion of people dying in hospital as opposed to at home. However, we still observed increases in hospital use among individuals who did not die following the intervention.

## Conclusions

Through the use of anonymised data linkage, we were able to construct matched control groups for eight POPP interventions. These control groups matched the intervention groups very well in terms of a wide range of characteristics, including age, sex, area-level deprivation, medical diagnoses, predicted risk of hospital admission (PARR scores) and prior health care use. Compared with some alternative evaluation approaches, this allowed us to measure more precisely the impact of the interventions on hospital use. We believe this evaluation approach has several advantages over traditional methods.

The matching process was constrained by the information available in routine data, so it is possible that our intervention groups and our control groups differed systematically from each other according to some other unknown factors that we were unable to observe. This is known as 'residual confounding' (i.e. confounding on the basis of unknown characteristics or variables) and the only way to avoid it completely would be to conduct a sufficiently large randomised controlled trial.

> We are confident about our matching in the majority of cases. The differences between the intervention and matched control groups were small.

In terms of observed characteristics, we are confident about our matching in the majority of cases. The differences observed between the intervention and matched control groups were small. For three interventions, however, we found higher death rates for the intervention group than for the corresponding control group. Although this could be explained by differences in the location of death, it might suggest that there were systematic unobserved differences between the intervention and control groups for these sites. Since we observed increases in hospital use among individuals who did not die following the intervention, we believe the results of our analysis are relatively robust.

As noted earlier, there was an expectation that only four of the interventions would provide evidence of a reduction in hospital use. When compared to controls, we did not find evidence of a reduction in emergency hospital admission rates for any of the eight interventions studied, and in some instances we found that there were more admissions in the intervention group than in the control group. In one site, the number of emergency bed-days was reduced, while in another site the intervention group had more bed-days than the control group. Overall, we found that the particular set of eight POPP interventions we studied did not appear to reduce the use of acute hospitals in the six to 12 months after the intervention. However, there were signs that one of the interventions reduced emergency hospital admissions for patients at high predicted risk.

Hospital reduction programmes may have been in place in the control areas, so our findings are best interpreted as being relative to what is provided for similar patients in those other areas. Nevertheless, our finding that some POPP interventions were associated with increases in hospital use may seem surprising. However, this phenomenon has been observed previously in other hospital avoidance initiatives, including the UK Evercare pilots.[6] One possible explanation is that the process of 'case finding' identifies new problems which result in individuals being referred into the health care system. In other words, when patients first began the interventions, the professionals may have identified problems that necessitated hospital admission. In short, more contact between individuals and health care professionals may have resulted in more hospital activity; possibly increasing the quality of care but without reducing costs in the short term.

It is also possible that the interventions might have reduced admissions if other changes had been made in the health care system in order for them to become effective. Equally, the interventions might have had an impact on the utilisation of primary care, community health care or social care, or they may have had an impact on hospital utilisation in the longer term. None of these effects could have been detected by the current study.

Nevertheless, the findings will come as a disappointment to those working to redesign services through schemes such as those covered in this study with the laudable twin aims of improving patients' quality of life whilst reducing net 'downstream' costs. It is worth reiterating that we only looked at hospital utilisation in eight of the 146 core interventions offered under POPP, and that only four of these were expected to have an impact on hospital use. It is possible that some of the other interventions were more effective, as suggested by the national evaluation.

## Wider applications of person-based risk-adjusted evaluation (PBRE)

This evaluation has shown how difficult it can be to design and implement interventions that effectively reduce net costs in the short term from unplanned averted hospital admissions. Moreover, it has also demonstrated the need for evaluation methods that take account of regression to the mean. As we have shown, a simple pre-post comparison of hospital admissions would have concluded that half of the interventions studied reduced admissions, whereas an analysis of control groups suggests that this was not the case.

In order to make the most of preventive interventions, it is crucial for commissioners and providers to understand the impact of the intervention in as close to real-time as possible. If interventions are shown to be effective, there may be wider interest in their application throughout the health and social care systems. Equally, if they are not effective, it might be possible to refine the case finding process, the intervention itself or connected services in order to improve impact. Indeed, in the United States, several organisations are developing 'impactability models' that attempt to identify the subgroup of high-risk patients in whom preventive care is expected to be most successful.[7]

The evaluation approach developed here is novel and offers several advantages over other approaches:

- **Compared to randomised controlled trials, the evaluation is light-touch.** It is far less expensive and does not raise concerns about the tendency of research subjects to act differently as a result of their awareness of being studied (the 'Hawthorne effect').
- **It exploits existing sources of routine NHS data.** This reduces the cost and burden of data collection. As routine data are updated on a regular basis, control groups can be constructed early in the lifetime of an intervention, and the impact of that intervention can be tracked on a regular and frequent basis to promote a 'virtuous cycle' of learning and improvement.
- **It exploits predictive modelling.** Predictive models such as the PARR model are widely used in the NHS, suggesting that commissioners already have some of the tools they require to evaluate interventions robustly.

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