

The cost of avoidable hospital admissions from 20 care homes in Edinburgh

Calculating the value of anticipatory care planning (ACP)

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Key Points

- Anticipatory care planning (ACP) is a person-centred, proactive “thinking ahead” approach whereby health and social care professionals support and encourage individuals, their families and carers to plan ahead of any changes in their health or care needs. When used in a care home setting, it has the potential to avoid unnecessary admissions to hospital among patients with complex care needs. Avoiding these hospital admissions has the potential to provide care more efficiently through the avoidance of lengthy hospital stays and the provision of alternative care in the person’s place of residence.
- With support from ihub, Healthcare Improvement Scotland, Edinburgh Health and Social Care partnership (EHSCP) has invested in improvement work to promote the uptake of ACP in 20 care homes. EEvIT compared the costs of avoidable hospital admissions during the improvement period (April 2018-March 19) to that in the previous year (2017-18).
- The main analysis found an observed saving of £325,557 associated with the reduced number of avoidable hospital admissions across the 20 care homes during 2018-19 (compared with the baseline year 2017-18).
- The data may be right-skewed by a small number of patients experiencing extremely long stays in hospital, natural year-on-year variation in the number of hospital admissions (avoidable or otherwise) and whether care home residents have similar lengths of stay in hospital as people who would otherwise be discharged home. We explored the impact of these issues on the saving in three ways:
 1. We estimated the median (interquartile range (IQR)) patient cost and applied this unit cost to all patients (per year) within the sample classed as having “avoidable” or “unavoidable” (see below for how admissions were classed into these two groups) admissions to hospital. Therefore we were able to calculate the total cost, rather than using the individual patient costs and summing these to get the total cost as was done for the main analysis. The saving estimated this way was £244,714 (IQR: £213,404 to £557,628).
 2. We considered the year-on-year variation in hospital admission numbers by identifying the additional number of hospital admissions that would have been required to keep the proportion of hospital admissions the same as the baseline year. This is because the baseline year also saw more unavoidable admissions (and therefore more admissions overall). This allowed us to adjust for the fact that the improvement year (2018-19) saw fewer hospital

admissions overall (not just avoidable admissions as a result of the intervention). The median (IQR) patient cost once this aspect of variation was accounted for was £171,335 (£149,413 to £390,419).

3. We explored the impact of using alternative average length of stay times, applying the cost of a bed day in hospital). These substituted lengths of stay were likely shorter (using general population length of stay specialty data for NHS Lothian patients) than the original estimate using speciality length of stay data specifically for those aged 65 and over within NHS Lothian, therefore allowing us to be cautious in our conclusions about the estimate of the total saving expected. The median (IQR) saving once this had also been taken into account was £149,934 (£121,198 to £390,419).
- These additional analyses reduced the estimate of savings expected from the roll out of ACP to these 20 care homes, from £325,557 in the main analysis to anywhere between £149,413 and £390,419. However, the saving from the main analysis still fell within the interquartile ranges for each of the additional analyses therefore it is reasonable to expect a saving that is approximate to this amount.

Main Report

Introduction

Anticipatory care planning (ACP) involves discussions between patients who have complex needs and the health and social care professionals who support them, to enable individuals to ‘think ahead’ and make informed choices about their care and support, and for these choices to be documented in a Key Information Summary (KIS) within their medical notes. By having an ACP in place, this can lead to fewer unplanned admissions to hospital.

With support from Healthcare Improvement Scotland, EHSCP has invested in improvement work to promote the uptake of ACP in 20 care homes¹. They wanted to know whether this investment had resulted in a reduction in avoidable hospital admissions of care homes residents aged 65 or over and if so, what were the savings to the NHS in terms of avoided costs associated with such a reduction. They approached the Evidence and Evaluation for Improvement Team (EEVIT) to assist with estimating the cost of this expected saving. To achieve this EEVIT compared the costs of avoidable hospital admissions during the improvement period (April 2018-March 2019) to that in the previous year (2017-18).

Patient population and data set

Anonymised patient data were provided to the EEVIT team [Personal communication, Anna Wimberley, October 2019] for a sample of 532 admissions to hospital that occurred from the 20 care homes during the two years April 2017 to March 2019 (314 admissions in 2017-18 and 218 admissions in 2018-19). The following data were provided for each hospital admission:

- date of the admission,
 - patient’s age
 - a brief (free text) note of the reason for the admission,
 - the arrangements for method of transport to hospital (a 999 call, the flow centre which co-ordinates GP ambulance requirements, or the Lothian Unscheduled Care Service – LUCS - during out of hours),
 - whether the admission was classed as avoidable (yes or no) and why the admission was classed as being avoidable or unavoidable.
-
- An avoidable admission was defined as one where: the person’s Key Information Summary (KIS) had had an Anticipatory Care Question (ACQ) for comfort care
 - avoidable if KIS has condition specific management plan
 - avoidable if KIS has condition specific treatment plan
 - avoidable if KIS was followed

The reasons for an admission being defined as unavoidable were:

- the KIS has preference to contact family but they were unavailable
- the patient diagnosis
- family preference
- for resuscitation
- hospitalisation is documented in KIS
- patient had capacity
- patient's preference

Method

The free text information about each admission was grouped into initial specialty codes. These were amended by two clinicians [Personal communication, Anna Wimberley, November 2019] and the NHS Information and Statistics Division (ISD) were requested to provide average length of stay data (which includes delayed discharge patients) by specialty, specifically for NHS Lothian residents aged 65 for both baseline and intervention year [Personal communication Natalie Cameron ISD, November 2019].

The ISD Cost Book workbook D040 (inpatient bed days)² was used to apply the net bed day cost to average length of stay values for those in this population (residents of NHS Lothian aged 65 and over) who were admitted to hospital as emergency patients. Where no admission was confirmed (or the specialty was defined as A&E – with no inpatient observation), the cost of an A&E attendance was used instead from workbook D020 (A&E non-inpatient attendance costs)³. Patient transport costs were assumed to require an ambulance given the emergency nature of admissions. Workbook R910 (NHS funded patient transport)⁴ was used. Cost book prices for the year (2018-19) were used.

Main analysis

Total cost of a patient's hospital visit was calculated by combining bed day cost with length of stay in days, plus journey costs.ⁱ The change in the total cost experienced by the patients whose hospital admission was classed as "avoidable" and "unavoidable" in the baseline year compared to the improvement period illustrated the potential saving associated with improving ACP in care homes in EHSCP.

ⁱ Where length of stay data provided indicated zero days or the patient was not coded as having been admitted, this was amended to enable the total cost to be calculated (A&E attendance cost).

Sensitivity analysis to account for variation in the data:

It was necessary to consider how normal year-on-year variation affects the saving, to explore the impact of length of stay data being typically right-skewed (whereby most people have short stays in hospital but averages are higher due to small numbers of people who experience long stays in hospital) and to be conservative about the potential saving in terms of days of hospital avoided as there may be differences (for example in the length of stay for people admitted from care homes in comparison to those admitted from their own homes).

- 1) The impact of uncertainty around hospital length of stay was explored by considering the difference in the median costs multiplied by the difference in the number of patients experiencing avoidable hospital admissions from the baseline year to the improvement year.
- 2) Using median costs we accounted for year-on-year variation in the total number of admitted patients (for example if 2018-19 was just a year where fewer patients were admitted to hospital or 2017-18 had substantially more admissions than previous years) by estimating the additional number of avoidable admissions expected in 2018-19 had the proportion of avoidable admissions been the same as the baseline year.
- 3) NHS Lothian average lengths of stay by speciality for all ages were applied to bed day costs, rather than the aged 65 years and older population. Given our study population of interest, it is preferable to capture those right-skewed lengths of stay in the main analysis, but it is possible that doing so this may overestimate average lengths of stay. Therefore it was important to account for the extent that this might have influenced results.

In all analyses the total cost for each visit was compared depending on whether it had been defined as having been avoidable or unavoidable.

Results

Average length of stay data for the main and sensitivity analysis (whereby length of stay for emergency admissions among the general population of NHS Lothian were substituted to estimate the impact on results as described above) are shown in Table 1.

Table 1: Length of stay data used in the main and sensitivity analysis

Specialty	Main analysis (aged 65+ population in NHS Lothian)		Sensitivity analysis (population of all ages in NHS Lothian)	
	2017-18	2018-19	2017-18	2018-19
Cardiology	4.9	5.4	4.3	4.6
Gastroenterology	7.6	9.0	6.8	8.3
General Medicine	5.5	5.8	4.4	4.6
General Surgery	5.9	5.9	4.2	4.0
Geriatrics	24.4	25.5	24.8	25.5
Haematology	-	6.2	-	4.7
Ophthalmology	3.8	-	3.3	-
Orthopaedics	13.9	13.8	10.2	10.1
Urology	6.8	6.1	4.9	4.8
Stroke/Vascular	11.1	11.8	-*	-*
Respiratory Medicine	7.1	7.4	6.2	6.4
Accident and Emergency	0.6	0.7	0.5	0.6

Main analysis

Following the application of bed day costs to length of stay data, estimates of the savings are shown in Table 2 below. The number of avoidable admissions was 35.4% (111/314) in the baseline year (2017-18) and 22.5% (49/218) in the improvement period (2018-19). The total saving seen in terms of the comparative total costs of avoidable admissions (£589,132 in 2017-18 and £263,575 in 2018-19) was £325,557.

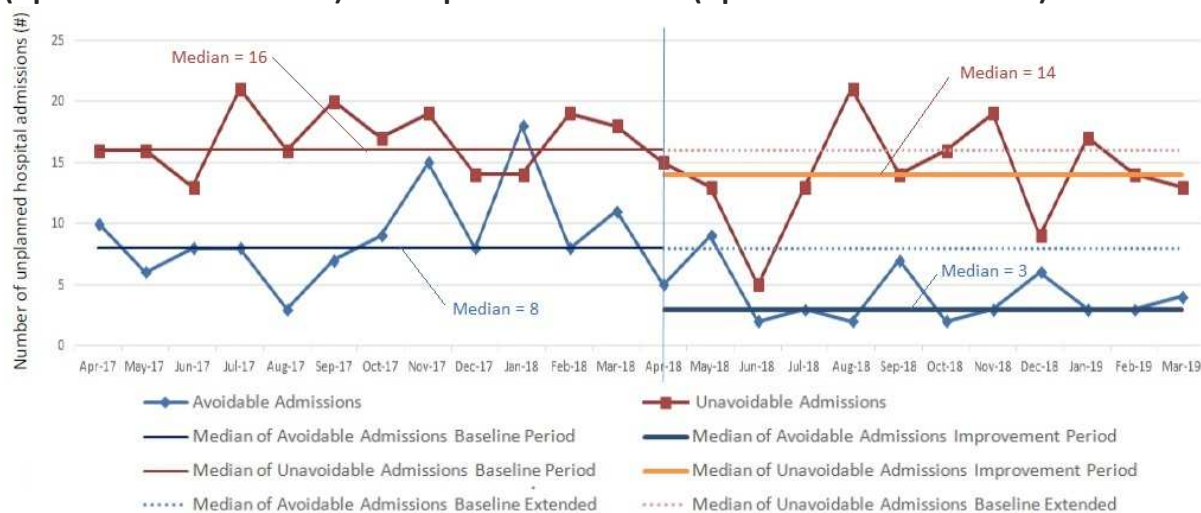
Table 2: Total savings estimated

	N	Costs		N	Costs	Saving
17-18 Total unplanned admissions	314	£1,990,721	18-19 Total unplanned admissions	218	£1,423,765	£566,956
Unavoidable	203	£1,401,589	Unavoidable	169	£1,160,190	£241,399
Avoidable	111	£589,132	Avoidable	49	£263,575	£325,557

Further details of the savings estimated for the individual reasons why a hospital admission was avoidable or otherwise are provided in the Appendix.

Overall, the change in the proportions of avoidable and unavoidable admissions was statistically significantⁱⁱ and a run chart shift was seen in the data over time as shown in Figure 1, which has been taken from the “Edinburgh Health and Social Care Partnership: A Local story from Living Well in Communities” report conducted for this project¹.

Figure 1: Unplanned hospital admissions from Phase 3 Care Homes: Comparison of Baseline (Apr 2017 to March 2018) and Improvement Period (April 2018 to March 2019)



ⁱⁱ The details of the statistical significance are as follows: 0.05 significance level, Chi-Squared (χ^2) test 9.536, degrees of freedom = 1, p-value=0.002)

Sensitivity analysis:

- 1) Right-skewed length of stay data: The median costs per patient in 2018-19 were £3,947 (£3,442 to £8,994), resulting in a total saving of £244,714 (IQR: £213,404 to £557,628) was estimatedⁱⁱⁱ.
- 2) Year-on-year variation: A total estimate of 261 unplanned admissions was calculated if there had been no year-on-year variation. Thus the saving in terms of avoidable admissions was 92-49 i.e. 43 patients. Therefore with a median cost per patient in 2018-19 of £3,947 (£3,442 to £8,994), results in a total savings estimate of £171,335 (£149,413 to £390,419)^{iv}.
- 3) Variation in length of stay: We applied general population emergency length of stay data for NHS Lothian (see columns in Table 1 for source data) to explore how variation in length of stay might influence results.

All sensitivity analysis results compared to the main analysis are shown in Table 3 below.

Table 3: Sensitivity Analysis exploring the impact of different avoidable per-patient costs, year-on-year variation and shorter lengths of stay.

Analysis	Result
Main Analysis	£325,557
Using Median Cost (IQR) per patient (Sensitivity Analysis 1)	£244,714 (£213,404 to £557,628).
Using Median (IQR) Cost per patient & adjusting for year-on-year variation in the number of hospital admissions (Sensitivity Analyses 1 & 2) ^v	£171,335 (£149,413 to £390,419)
Using general population length of stay data	£307,192

ⁱⁱⁱ To account for length of stay data being right-skewed we considered the difference in the median costs per patient multiplied by the difference in the number of patients experiencing avoidable hospital admissions from the baseline year (111) to the improvement period (49) i.e. 62 patients.

^{iv} We accounted for inherent year-on-year variation from in the number of admissions by considering the number of avoidable admissions (including those seen in 2018-19) that would have been needed to maintain the *proportion* of avoidable admissions observed during the base year (35.35%). With 49 avoidable admissions seen out of 218 (22.5%) in the follow up year, a total of 92 avoidable admissions would be needed (including the 49 seen in practice and an additional 43 patients).

^v It was not possible to conduct Sensitivity Analysis 2 on its own as this would have required making assumptions about specialty-level length of stays for hypothetical patients (not seen in the improvement year because of natural year-on-year variation in the total number of admissions).

(IQR)	
(Sensitivity Analysis 3)	
Using general population length of stay data and median cost per patient and adjusting for year-on-year variation in the number of hospital admissions	£149,934 (£121,198 to £390,419)
(Sensitivity Analyses 1 & 2 & 3)	

Limitations

While the sample size is reasonable, the data relate to hospital admissions rather than individual patients. The average number of admissions per patient is not known.

The analysis did not take into account the resource impact associated with implementation during the improvement period in terms of improvement support, train-the-trainer training (to ensure new staff can be trained in-house) and staff time to develop and organise implementation. While it is difficult to quantify the hours (and therefore the associated resource use) with doing so, as there is no expected ongoing cost associated with this improvement, the resource impact of implementation is not expected to alter the conclusion that this service improvement results in cost savings.

The estimated saving is specific to the 20 care homes included in this analysis, and it is not clear how applicable the results are to other parts of the same HSCP or to other HSCPs outwith Edinburgh City. In terms of the cost of NHS Boards implementing improvements in ACP across care home settings, the approach taken by EHSCP sought to embed sustainability from the start. If other HSCPs implement ACP in their areas there may be variation in the potential for savings depending on how they implement the intervention.

The proportion of all admissions that were avoidable from month to month varied during the base year (see Figure 1). The range of variation was extensive; between 15.8% and 54.8% during the base year and between 8.7% and 40.9% in the follow up year. However, owing to the small numbers of patients informing the data at the monthly level, it was not possible to incorporate this inherent month to month variation into the sensitivity analysis that was undertaken.

Discussion

Despite these limitations it is still clear that implementing ACP in care homes in Edinburgh results in a cost saving, which the main analysis estimated savings to be £325,557.

While sensitivity analysis reduced this estimate, we note that the value from the main analysis still falls within the interquartile range of what is expected once we adjust to account for year-on-year differences in admission numbers, patient costs and varying lengths of stay. This allows us some degree of reassurance that this savings estimate is not overly sensitive to the inherent uncertainties associated with natural variation in hospital admissions year-on-year, or right-skewed costs as a result of small numbers of patients having very long stays in hospital, a relevant consideration for this particular group of patients.

Savings are not likely to be cash-releasing as they relate specifically to the potential to reduce hospital activity. Savings are also likely to be non-recurring if ACPs become a standard component of medical case notes as most people will then already have them in place.

Conclusion

Anticipatory care planning has been shown to reduce hospital inpatient activity costs. The observed total cost saving shown in NHS Lothian was £325,557. By accounting for inherent variation in patient costs and the number of hospital admissions year-on-year, savings of between £149,413 and £390,419 could be reasonably expected in this population (2018-19 prices). The savings represent a more efficient use of resources, and while they are not cash releasing, they lead to a greater likelihood that appropriate care is provided in appropriate settings.

Acknowledgements

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Glossary of Terms

“Baseline” – “a usually initial set of critical observations or data used for comparison or a control”⁵.

“Interquartile range” – “the difference between the first [quartile - 25 % of the cases have lower values] and third quartile [75 % of cases have lower values] quartiles”⁶.

“Median” – “the value of the variable such that half of the cases are lower in value and half are higher in value”⁶.

“Right skewed” – “most cases have low values of the variable, and a few outliers have very high values”⁵.

“Sensitivity analysis” – “used to illustrate and assess the level of confidence that may be associated with the conclusion of an economic evaluation. It is performed by varying key assumptions made in the evaluation (individually or severally) and recording the impact on the result (output) of the evaluation”⁷.

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Appendix: Admissions Data

Further descriptive statistics about avoidable and unavoidable admissions can be found below.

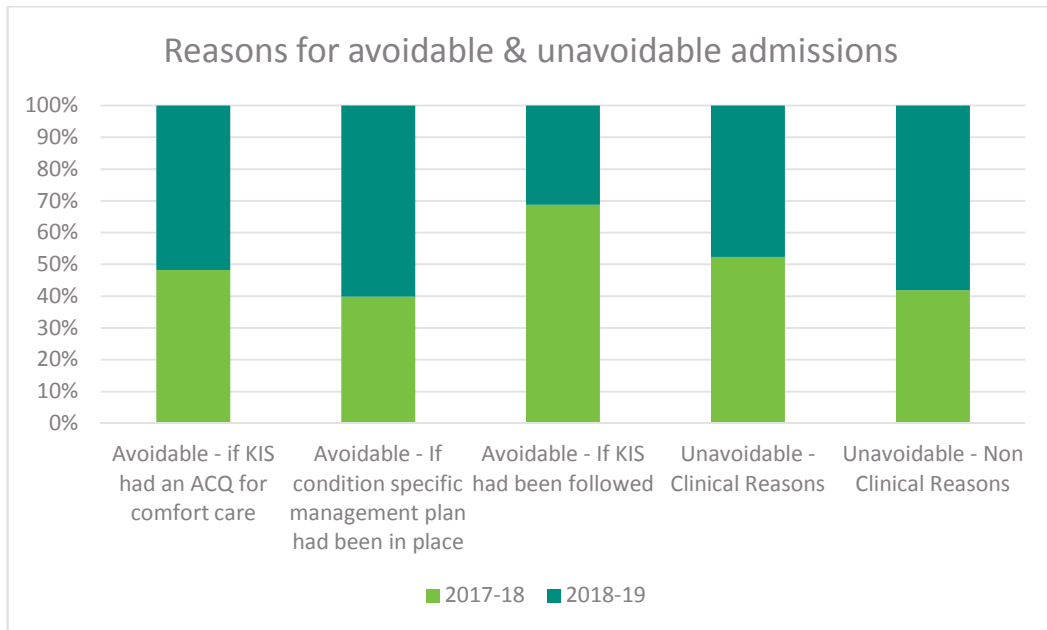
In terms of the reason for admissions being avoidable the overwhelming majority of the avoidable costs were due to the patient's KIS not having an ACQ for comfort care (£752,214; 88.2% of the total avoidable costs). This affected 93 patients in the base year (£506,354) and 44 in the 2018-19 (at a cost of £245,860). Therefore the saving in terms of reduced costs was £260,494. In terms of the median costs avoided given 49 fewer patients were affected in the follow up year, the saving is around £193,403 (IQR: £168,658 to £440,706).

Other avoidable reasons for admissions accounted for £18,747; 2.2% (avoidable if KIS has condition specific treatment plan/management plan). This affected 3 patients in the base year and 2 in the follow up year and so the absolute saving in terms of cost was £3,969, or (as one fewer person was affected in the follow up year) the median per patient cost of £3,947 (£3,442 to £8,994).

Having a KIS that had not been followed (in cases where it should have been followed) cost £81,746 and affected 9.6% of participants i.e. 15 in 2017-18 and 3 in 2018-19. The saving in terms of reduced costs in the follow up year was £61,094. Based on the median cost for the follow up year and the additional 12 participants who did not experience this at follow up, the saving was £47,364 (IQR: £41,304 to £107,928).

There were 203 unavoidable visits to hospital in 2017-18 and 169 in 2018-19. These are shown in Figure 2 below.

Appendix Figure 1: Reasons for avoidable and unavoidable admissions



Of the total unavoidable visits to hospital across these years (372), 288 (77.4% of all unavoidable visits) were due to clinical reasons (diagnosis or resuscitation) whereas the remaining 84 (22.6%) were due to patient choice (e.g. within KIS) and capacity, or family preferences (or inability to contact the family to confirm patient preferences). It is not clear how patient preferences may change in future in order to predict future costs avoided by further implementing ACP.

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