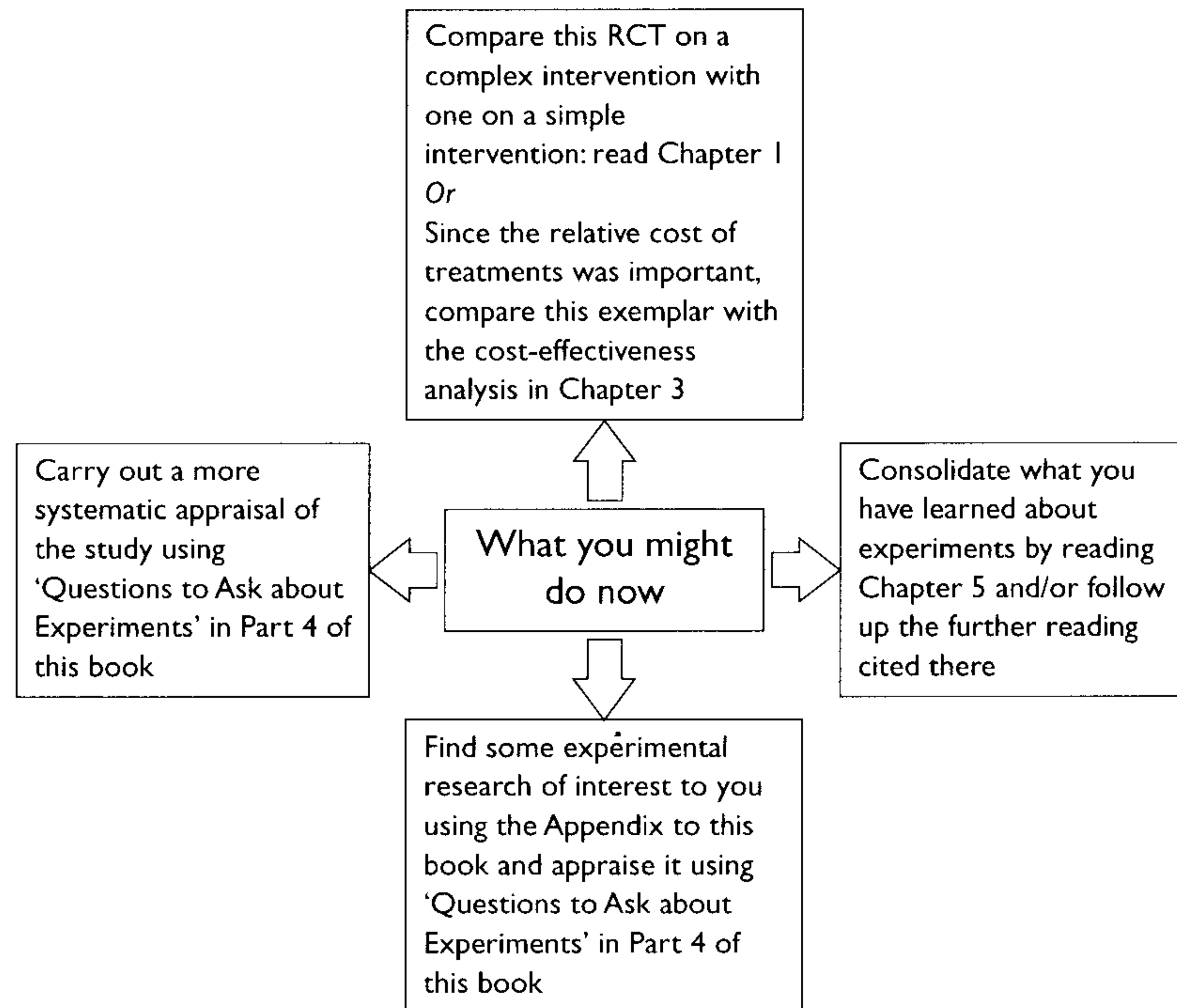


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- 15 Segal S, Aviram U. Community-based sheltered care: a study of community care and social integration. New York: Wiley-Interscience, 1977.
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### What you might do now



## CHAPTER 3

# FROM EFFECTIVENESS TO COST-EFFECTIVENESS: A TRIAL OF A HOSPITAL AT HOME SCHEME

Shepperd, S., Harwood, D., Gray, A., Vessey, M. and Morgan, P. (1998) 'Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis', *British Medical Journal*, 316: 1791–6

EXEMPLAR

### What you need to understand in order to understand the exemplar

You can accept that the RCT establishing the similar effectiveness of the two interventions was well-designed and well-conducted, but if you want to investigate experimental design for research on effectiveness, see the *Introduction to this chapter and Chapter 5*

'analysis was done on an intention to treat basis'  
*See Chapter 5, section 8*

'When appropriate, data with a non-normal distribution was log transformed before further parametric analysis was done.'  
(The use of the geometric mean is for the same reason.)  
*See Chapter 6, section 4 (data transformations); Chapter 7, section 6*

What the figures for standard deviation (SD) tell you.  
*See Chapter 7, section 9*

*P* values and how to interpret them (where no *p* values are cited the results are not statistically significant at the 0.05 (5%) level).  
*See Chapter 7, section 2 (especially Table 7.2)*

Confidence intervals and how to interpret them.  
*See Chapter 7, sections 4 and 5*

Sensitivity analysis.  
*See Chapter 7, section 12*

The problems of generalising from a cost-effectiveness study done in one locale to cost-effectiveness elsewhere.  
*See Chapter 5, section 12*

## Introduction

During the 1990s in the UK many hospital at home schemes were established on the assumption that providing postoperative care in a patient's home would be cheaper than providing it on an inpatient basis. However, there was almost no research evidence to back up this assumption. The exemplar study for this chapter is one of a number investigating this towards the end of the 1990s. Often studies like this are called *cost-effectiveness analyses*, though more narrowly defined this one is a *cost-minimisation analysis*, where the object is to decide which of two equally effective interventions has the lowest costs. Cost-effectiveness analyses, narrowly defined, try to establish how much benefit is produced per unit cost. All such analyses have to include, or build on, research establishing the relative effectiveness of interventions, before their relative *cost-effectiveness* can be considered. The most convincing evidence about effectiveness comes from randomised controlled trials and the exemplar printed here is the second half of a study which began with an RCT (Figure 3.1).

The way that patients were recruited for the trial is shown in Figure 5.4 in Chapter 5. Table 3.1 below comes from the first half of the study. It refers only to the hip replacement patients. The trial included patients in other care groups as well, and these mainly show similar results. The results are produced from the use of COOP charts (Figure 6.1 in Chapter 6) and a clinical test for the Oxford hip score. The two groups were very similar at baseline. Their difference here was also tested for statistical significance separately. The standard deviation figures (SD) show that internally the two groups were not very different in diversity (Chapter 7, section 9). The outcome differences were calculated by subtracting one group's average (mean) change from baseline to 3 months from that of the other group (Chapter 7, section 10.1). A positive score would show more improvement for the hospital at home patients. Most of the 95% confidence intervals (Chapter 7, sections 4 and 5) give limits which span values that would

Figure 3.1 The main components of an analysis of cost-effectiveness

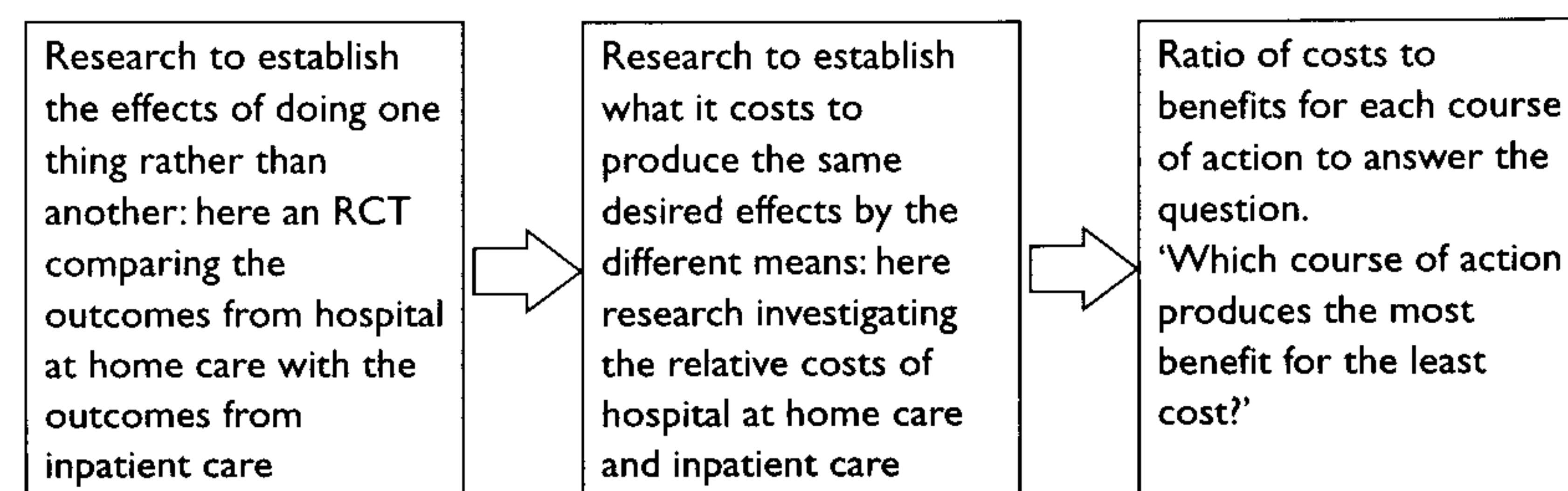


Table 3.1 Outcome measures reported by patients recovering from hip replacement who were allocated to hospital at home care ( $n = 37$ ) or inpatient care ( $n = 49$ )

|  | Mean (SD) value at baseline  |                              | Mean change from baseline value at 3 month follow up |                       |                       |
|--|------------------------------|------------------------------|--|-----------------------|-----------------------|
|  | HaH ( $n = 36$ )             | Hospital ( $n = 48$ )        | HaH ( $n = 36$ )                                     | Hospital ( $n = 45$ ) | Difference (95% CI)   |
| <b>Dartmouth COOP charts<sup>1</sup></b> |                              |                              |  |                       |                       |
| Physical fitness                         | 4.58 (0.91)                  | 4.73 (0.49)                  | 0.42   | 0.51                  | -0.09 (-0.48 to 0.29) |
| Feelings                                 | 2.44 (1.08)                  | 2.60 (1.16)                  | 1.03   | 0.78                  | 0.25 (-0.29 to 0.79)  |
| Daily activities                         | 3.17 (1.13)                  | 3.40 (0.98)                  | 1.00   | 0.93                  | 0.07 (-0.39 to 0.53)  |
| Social activities                        | 2.92 (1.27)                  | 3.10 (1.19)                  | 1.43   | 1.02                  | 0.41 (-0.15 to 0.97)  |
| Pain                                     | 4.33 (0.76)                  | 4.46 (0.68)                  | 1.54   | 1.69                  | -0.15 (-0.78 to 0.49) |
| Change in health                         | 2.44 (0.94)                  | 2.44 (0.92)                  | 0.74   | 0.13                  | 0.61 (0.02 to 1.20)   |
| Overall health                           | 2.78 (0.76)                  | 2.85 (1.01)                  | 0.06   | -0.04                 | 0.10 (-0.35 to 0.55)  |
| Social support                           | 1.56 (0.84)                  | 1.90 (1.34)                  | 0.26   | 0.40                  | -0.14 (-0.57 to 0.28) |
| Quality of life                          | 2.94 (0.83)                  | 2.73 (0.74)                  | 0.97   | 0.47                  | 0.59 (0.13 to 0.88)   |
| Oxford hip score <sup>2</sup>            | ( $n = 34$ )<br>25.56 (6.15) | ( $n = 46$ )<br>27.34 (8.03) | ( $n = 43$ )<br>4.77                                 | ( $n = 43$ )<br>3.13  | 1.64 (-1.23 to 4.50)  |

HaH, Hospital at home care.

<sup>1</sup> Scale 1-5 (low score = good quality of life).

<sup>2</sup> No data for some patients, scale 12-60 (high score = high level of impairment). Baseline score measured at 1 month.

Source: Shepperd, S., Harwood, D., Jenkinson, C., Gray, A., Vessey, M. and Morgan, P. (1998) 'Randomised controlled trial comparing hospital at home care with inpatient hospital care. I: three month follow up of health outcomes', *British Medical Journal*, 316: 1788

show more improvement for either group, thus suggesting no significant differences. All the outcome differences were tested for statistical significance (Chapter 7, sections 1 and 2). None in this table showed statistical significance at the 0.05 (5%) level, which is indicated by the authors not including any values for  $p$  (Table 7.2 in Chapter 7).

Overall then, the researchers could be confident that, in most respects, for most patient groups involved in the trial there was little difference in health outcomes associated with receiving inpatient care or hospital at home care. The exemplar study focuses on which of these two interventions 'cost' least.

In analyses like this it is important to note that:

- 1 'Costs' and 'benefits' are not restricted to monetary matters.
- 2 Combining monetary and non-monetary costs in the same analysis can lead to tricky problems: for example, how much should patient discomfort raise the cost of a treatment above its monetary cost? Or how much extra should service managers be willing to pay for an intervention which patients prefer, but which provides no additional health gain?

- 3 Cost-benefit ratios are always from someone's point of view. A cost for someone, may be a benefit to someone else.
- 4 For all these reasons and others, economic analysis entails making moral judgements about:
  - whose interests should be taken into consideration in deciding what to count as costs and benefits, and what to ignore;
  - whose interests should take highest priority when setting the costs for one party against benefits to another.

These are matters you might like to bear in mind when you read the exemplar study.

You will see that the authors explain how they costed care, but do not present a great deal of the data for this. This is common, since such data would take a very large amount of space. However, the authors offer to make it available if required. This is important if a reader wants to compare unit costs in the study with unit costs in their own practice area.

## RANDOMISED CONTROLLED TRIAL COMPARING HOSPITAL AT HOME CARE WITH INPATIENT HOSPITAL CARE. II: COST MINIMISATION ANALYSIS

Sasha Shepperd, Diana Harwood, Alastair Gray, Martin Vessey,  
Patrick Morgan

### Abstract

**Objectives:** To examine the cost of providing hospital at home in place of some forms of inpatient hospital care.

**Design:** Cost minimisation study within a randomised controlled trial.

**Setting:** District general hospital and catchment area of neighbouring community trust.

**Subjects:** Patients recovering from hip replacement ( $n = 86$ ), knee replacement ( $n = 86$ ) and hysterectomy ( $n = 238$ ); elderly medical patients ( $n = 96$ ); and patients with chronic obstructive airways disease ( $n = 32$ ).

**Interventions:** Hospital at home or inpatient hospital care.

**Main outcome measures:** Cost of hospital at home scheme to health service, to general practitioners, and to patients and their families compared with hospital care.

**Results:** No difference was detected in total health care costs between hospital at home and hospital care for patients recovering from a hip or knee replacement, or

elderly medical patients. Hospital at home significantly increased health care costs for patients recovering from a hysterectomy (ratio of geometrical means 1.15, 95% confidence interval 1.04 to 1.29,  $p = 0.009$ ) and for those with chronic obstructive airways disease (Mann-Whitney  $U$  test,  $p = 0.01$ ). Hospital at home significantly increased general practitioners' costs for elderly medical patients (Mann-Whitney  $U$  test,  $p < 0.01$ ) and for those with chronic obstructive airways disease ( $p = 0.02$ ). Patient and carer expenditure made up a small proportion of total costs.

**Conclusion:** Hospital at home care did not reduce total health care costs for the conditions studied in this trial, and costs were significantly increased for patients recovering from a hysterectomy and those with chronic obstructive airways disease. There was some evidence that costs were shifted to primary care for elderly medical patients and those with chronic obstructive airways disease.

### Introduction

There is little evidence to justify the widespread adoption of hospital at home on the basis of cost. A review of the subject identified only one randomised controlled trial that compared the cost of hospital at home with inpatient hospital care.<sup>1</sup> This trial, based in the United States, recruited patients with a terminal illness and found no difference in overall health care costs.<sup>2</sup> There is conflicting evidence from non-randomised studies.<sup>3,4</sup>

We report the results of a prospective economic evaluation, in the context of a randomised controlled trial, of the cost of providing hospital at home as a substitute for some forms of inpatient hospital care. The three questions addressed by the economic evaluation were

- Does substituting hospital at home care for hospital care result in a lower cost to the health service?
- Does hospital at home care, compared to hospital care, increase the cost to general practitioners?
- Does hospital at home care increase the cost borne by the patients and their families compared with hospital care?

#### Uses of health service resources that were recorded for cost minimisation analysis

##### Hospital care

- Number of inpatient days
- Number of inpatient days due to a hospital readmission related to the trial diagnosis
- Medication

##### Hospital at home care

- Number of hospital at home days
- Number of hospital at home visits (including duration of visit and grading of staff)
- Medication

##### Hospital transport

- Number of journeys made by ambulance or a health service car

##### General practitioner visits

- Number of visits to doctor's surgery
- Number of home visits

## Methods

We describe patient recruitment and randomisation in our accompanying paper [not reprinted in this volume; see Introduction].<sup>5</sup> This economic evaluation took the form of a cost minimisation analysis, as the health outcomes of the two arms of the trial did not differ. Our primary interest was the cost to the health service, but we also examined the costs incurred by patients and families, as they could influence the acceptability of a hospital at home scheme.

We recruited five groups of patients: patients recovering from a hip replacement, a knee replacement, or a hysterectomy; patients with chronic obstructive airways disease; and elderly patients with a mix of medical conditions. All patients were aged 60 years or over, except those recovering from a hysterectomy, who were aged 20–70 years.

### Data collection

The box lists the uses of health service resources on which data were collected. We obtained cost data for hospital care and hospital at home care from the respective trusts' finance departments for the financial year 1994–5, apportioned on the basis of activity for 1993–4. Details of the unit costs are available from the authors.

**Hospital costs** The cost of hospital care included staffing costs, all non-staff running costs, and capital costs. Patient dependency scores were developed by hospital nursing and medical staff to reflect the marginal costs incurred during a patient's episode of hospital care (and hence the marginal savings of early discharge).<sup>3,6</sup> These scores were used to weight the costs for each day that a patient was in hospital. The costs of physiotherapy and occupational therapy were calculated according to the amount of time spent with a typical patient for each clinical group, and included a cost for non-contact time. Equipment costs (based on ward records), the cost of items not directly related to levels of patient care, and capital charges for land and buildings (based on valuation and including interest and depreciation) were divided by the number of ward bed days for the year 1994–5 to arrive at a charge per bed day. The cost of prescribed drugs was obtained from the hospital pharmacy department.

The time profile for costing hospital care differed for each clinical group. The costs for surgical patients excluded the costs of the operation, as these costs do not alter with different rehabilitative care. For patients having a hip or knee replacement, costs were calculated from the fourth postoperative day. For patients having a hysterectomy, costs were calculated from the first postoperative day. Cost data for medical patients were collected for the duration of their hospital stay.

**Hospital at home costs** The cost of hospital at home care included all staffing and non-staff running costs. The costs of nurses, physiotherapists, and occupational therapists were based on the amount of time spent with patients, and included a cost for non-contact time. The following non-staff costs were included: central administration, travel, training, telephones and pagers, equipment, and office space. Medical supplies and equipment costs were depreciated over a 10 year period with a discount rate of 6%.<sup>7</sup> These costs were apportioned on an equal basis to each patient receiving hospital at home care, assuming costs were payable in advance at

the start of the year. Administration and travel costs were apportioned according to the volume of patients. The cost of prescribed drugs was obtained from the hospital's pharmacy department.

**General practitioner costs** Research nurses visited each practice to record the number of general practitioners' home visits and number of patients' visits to the surgery. The community trust providing the hospital at home care reimbursed general practitioners visiting hospital at home patients at a rate of £100 per patient and £25 for each visit. General practitioner costs for the hospital care group were calculated with unit costs developed by the Personal Social Services Research Unit, Kent.<sup>8</sup>

**Carer costs** Carers were asked to record all expenditures related to the trial diagnosis (including equipment and adaptations, consumables, and travel) in a diary for one month, and any loss of earnings and days off work due to caring for their patient. Carers were also asked to record the number of hours a day they spent caring for the patient.

### Statistical analysis

We describe the sample size calculations in our accompanying paper [not reprinted here].<sup>5</sup> Analysis was done on an intention to treat basis. When appropriate, data with non-normal distribution was log transformed before further parametric analysis was done. The Mann–Whitney *U* test was used for continuous variables that did not approximate a normal distribution after log transformation.

Sensitivity analyses were conducted for areas that could possibly restrict the generalisability of the trial results. These were the trial rate of reimbursing general practitioners, patients' duration of hospital at home care observed in the trial, and the use of average costs per inpatient day instead of dependency adjusted hospital costs.

## Results

Results are presented by clinical condition for both arms of the trial. Inpatient hospital care and hospital at home care accounted for most of the health care costs. Tables 1, 2 and 3 show health service resources and costs for each patient group.

### Early discharge of patients after elective surgery

Patients allocated to hospital at home care after a hip or knee replacement or a hysterectomy spent significantly fewer days in hospital (Tables 1 and 2). However, they received significantly more days of health care with the addition of hospital at home. For patients recovering from a hip or knee replacement, the total costs to the health service were not significantly different between the two groups. For patients recovering from a hysterectomy, total health service costs were significantly higher for those allocated to hospital at home care. Of the total numbers of patients undergoing these procedures during the study period, we recruited about 20% of all those having hip replacements, 25% of those having knee replacements, and 35% of those undergoing hysterectomy.

**Table 1 Health service resources and costs consumed at 3 months after hospital admission by patients allocated to hospital at home care or inpatient hospital care: orthopaedic patients recovering from hip or knee replacement**

|  | Hospital at home          | Hospital                 | Difference (95% CI)                                  |
|--|---------------------------|--------------------------|--|
| <b>Hip replacement:</b>  |                           |                          |  |
| Mean (SD) days in hospital care                                    | (n = 36)*<br>8.11 (5.52)  | (n = 49)<br>11.87 (4.52) | -3.75 (-5.92 to -1.58)                               |
| Mean (SD) days in hospital at home care                            | 6.58 (4.26)               | —                        | —  |
| Mean (SD) total days of care                                       | 14.69 (5.13)              | 11.87 (4.57)             | 2.84 (0.75 to 4.93)                                  |
| Median (interquartile range) days of readmission                   | 0 (0.00-0.00)             | 0 (0.00-0.00)            | p = 0.39†  |
| Mean (SD) hospital costs including readmission (£)                 | 515.42 (473.20)           | 776.30 (364.53)          | -260.87 (-441.56 to -80.19) p < 0.01                 |
| Mean (SD) hospital at home costs (£)                               | 351.24 (240.58)           | —                        | —  |
| Median (interquartile range) GP costs: home and surgery visits (£) | 42.84 (0.00-64.61)        | 15.49 (0.00-45.19)       | p = 0.06‡  |
| Mean (SD) total health service costs (£)                           | 911.39 (563.76)           | 815.70 (347.99)          | Ratio of geometric mean 1.05 (0.87 to 1.27) p = 0.59 |
| <b>Knee replacement:</b>   |                           |                          |  |
| Mean (SD) days in hospital care                                    | (n = 46)‡<br>10.28 (4.60) | (n = 39)<br>13.31 (4.57) | -3.02 (-5.01 to -1.04)                               |
| Mean (SD) days in hospital at home care                            | 5.72 (4.98)               | —                        | —  |
| Mean (SD) total days of care                                       | 16.00 (5.44)              | 13.31 (4.57)             | 2.69 (0.50 to 4.88)                                  |
| Median (interquartile range) days of readmission                   | 0 (0.00-0.00)             | 0 (0.00-0.00)            | p = 0.23‡  |
| Mean (SD) hospital costs including readmission (£)                 | 1092.24 (615.27)          | 1348.35 (625.94)         | -256.11 (-524.61 to 12.38) p = 0.06                  |
| Mean (SD) hospital at home costs (£)                               | 348.16 (275.25)           | —                        | —  |
| Median (interquartile range) GP costs: home and surgery visits (£) | 15.49 (0.00-57.15)        | 15.49 (0.00-30.98)       | p = 0.22‡  |
| Mean (SD) total health service costs (£)                           | 1461.62 (666.61)          | 1375.36 (637.76)         | Ratio of geometric mean 1.05 (0.88 to 1.26) p = 0.55 |

GP = general practitioner.

\* No data available for 1 patient.

† Mann-Whitney U test.

‡ No data available for 1 patient.

**Table 2 Health service resources and costs consumed at 3 months after hospital admission by patients allocated to hospital at home care or inpatient hospital care: patients recovering from hysterectomy**

|  | Hospital at home    | Hospital            | Difference (95% CI)                                  |
|--|---------------------|---------------------|--|
| <b>Hospital at home (n = 111)*</b>                                 |                     |                     |  |
| Mean (SD) days in hospital care                                    | 4.34 (1.86)         | 5.79 (2.98)         | -1.44 (-2.09 to -0.79)                               |
| Mean (SD) days in hospital at home care                            | 3.11 (2.64)         | —                   | —  |
| Mean (SD) total days of care                                       | 7.45 (2.59)         | 5.79 (2.98)         | 1.66 (0.94 to 2.39)                                  |
| Median (interquartile range) days of readmission                   | 0 (0.00-0.00)       | 0 (0.00-0.00)       | p = 0.21‡  |
| Mean (SD) hospital costs including readmission (£)                 | 487.43 (350.20)     | 647.77 (496.27)     | Ratio of geometric mean 0.76 (0.67 to 0.87) p < 0.01 |
| Mean (SD) hospital at home costs (£)                               | 250.18 (273.54)     | —                   | —  |
| Median (interquartile range) GP costs: home and surgery visits (£) | 30.98 (15.49-61.96) | 30.98 (15.49-61.96) | p = 0.70‡  |
| Mean (SD) total health service costs (£)                           | 771.78 (408.72)     | 679.39 (439.83)     | Ratio of geometric mean 1.15 (1.04 to 1.29) p < 0.01 |

GP = general practitioner.

\* No data available for 3 patients.

† No data available for 1 patient.

‡ Mann-Whitney U test.

**Table 3 Health service resources and costs consumed at 3 months after hospital admission by patients allocated to hospital at home care or inpatient hospital care: elderly medical patients and patients with chronic obstructive airways disease**

|   | Hospital at home          | Hospital                   | Difference (95% CI)    |
|---|---------------------------|----------------------------|------------------------|
| <b>Elderly medical:</b>   |                           |                            |                        |
| Mean (SD) days in hospital care                                       | (n = 50)<br>12.84 (14.69) | (n = 44*)<br>13.20 (14.19) | -0.36 (-6.30 to 5.57)  |
| Mean (SD) days in hospital at home care                               | 9.04 (7.79)               | —                          | —                      |
| Mean (SD) total days of care  | 21.88 (18.30)             | 13.20 (14.19)              | 8.67 (1.90 to 15.45)   |
| Median (interquartile range) days of readmission                      | 0 (0.00-1.00)             | 0 (0.00-0.00)              | p = 0.08†              |
| Median (interquartile range) hospital costs including readmission (£) | 913.76 (243.31-2045.68)   | 1366.16 (629.08-2033.50)   | p = 0.21†              |
| Mean (SD) hospital at home costs (£)                                  | 793.45 (811.36)           | —                          | —                      |
| Median (interquartile range) GP costs: home and surgery visits (£)    | 67.84 (45.19-172.83)      | 45.19 (15.49-82.95)        | p < 0.01†              |
| Median (interquartile range) total health service costs (£)           | 1705.32 (913.83-3121.55)  | 1388.76 (645.06-2094.88)   | p = 0.09†              |
| <b>Chronic obstructive airways disease:</b>                           |                           |                            |                        |
| Mean (SD) days in hospital care                                       | (n = 15)<br>6.93 (3.39)   | (n = 17)<br>12.12 (7.49)   | -5.18 (-9.48 to -0.89) |
| Mean (SD) days in hospital at home care                               | 5.33 (3.94)               | —                          | —                      |
| Mean (SD) total days of care  | 12.27 (3.69)              | 12.12 (7.49)               | 0.15 (-4.21 to 4.51)   |
| Median (interquartile range) days of readmission                      | 5.00 (0.00-10.0)          | 0.00 (0.00-3.00)           | p = 0.08†              |
| Median (interquartile range) hospital costs including readmission (£) | 1389.53 (821.65-1993.97)  | 1198.53 (712.00-1508.24)   | p = 0.56†              |
| Mean (SD) hospital at home costs (£)                                  | 710.61 (526.50)           | —                          | —                      |
| Median (interquartile range) GP costs: home and surgery visits (£)    | 115.38 (25.00-214.30)     | 15.49 (0.00-91.02)         | p = 0.02†              |
| Median (interquartile range) total health service costs (£)           | 2379.67 (1458.09-2759.05) | 1247.64 (772.50-1619.19)   | p = 0.01†              |

GP = general practitioner.

\* No data available for 2 patients.

† Mann-Whitney U test.

#### Elderly medical patients and patients with chronic obstructive airways disease

No significant difference was detected between the two groups of elderly medical patients in the number of days spent in hospital, but, with the addition of hospital at home care, the total days of health care for the hospital at home group was significantly higher (Table 3). Patients with chronic obstructive airways disease in the hospital at home group spent significantly fewer days in hospital, but this reduction was offset by the time spent in hospital at home care so there was no significant difference between the two groups for the total days of health care (Table 3). For elderly medical patients, total costs to the health service were not significantly different between the two groups. Patients with chronic obstructive airways disease allocated to hospital at home care incurred significantly greater health care costs than did those receiving only hospital care. About 1% of all patients admitted for medical conditions during the study period were recruited to either the elderly medical or chronic obstructive airways disease groups. Nineteen of these patients were recruited by general practitioners, of whom nine were allocated to hospital care. However, only two of these patients received acute hospital care.

#### General practitioner costs

For patients discharged early after elective surgery, no significant differences in general practitioner costs were detected between the two groups. However, for elderly medical patients and those with chronic obstructive airways disease, the costs of general practitioner services were significantly higher for the patients allocated to hospital at home care compared with those in the hospital groups.

#### Costs to patients and carers

Patients' and carers' expenses made up a small proportion of total costs. There were no significant differences between the two groups for any of the categories of patients, and inclusion of these costs did not alter the results. The median cost for all patient groups was £0. The greatest expense was incurred by patients with chronic obstructive airways disease: median cost for the hospital at home group was £0 (interquartile range £0-£19.8) and for the hospital group was £0 (£0-£0). There were no significant differences between the two groups of carers in the time spent caring for the patient, although this was a substantial element in both groups. Few carers reported loss of earnings from caring for the patient, as most of the carers were retired. Further details of these costs will be published elsewhere.

#### Sensitivity analysis

Table 4 shows the results of the sensitivity analyses. Reducing length of stay in hospital at home care changed the difference in total health care costs for patients recovering from a hysterectomy and for those with chronic obstructive airways disease. A one day reduction eliminated the difference in cost for patients recovering from a hysterectomy, while a two day reduction altered the results so that hospital at home care became significantly less costly than hospital care for these patients. Costs remained significantly more expensive for patients with

**Table 4 Sensitivity analysis: comparing costs of hospital care, dependency adjusted costs and average costs, with costs of hospital at home care after reducing lengths of stay by one or two days**

|   | Hip replacement<br>HaH (n = 36) v<br>hospital (n = 49) | Knee replacement<br>HaH (n = 46) v<br>hospital (n = 39) | Hysterectomy<br>HaH (n = 111) v<br>hospital (n = 123) | Elderly medical<br>HaH (n = 50) v<br>hospital (n = 44) | Chronic obstructive<br>airways disease<br>HaH (n = 15) v<br>hospital (n = 17) |
|---|--|---|---|--|---|
| Trial results: difference in total health care costs using dependency adjusted hospital costs |  |   |   |  |   |
| Difference in cost (£)  | Mean 95.68   | Mean 86.26  | Mean 92.40  | Median 316.56  | Median 1132.03  |
| Ratio of geometric mean (95% CI)  | 1.05 (0.87 to 1.27)                                    | 1.05 (0.88 to 1.26)                                     | 1.15 (1.04 to 1.29)                                   | —  | —   |
| p value   | 0.59   | 0.55  | 0.009   | 0.09   | 0.01  |
| Sensitivity analysis: difference in total health care costs using average hospital costs      |  |   |   |  |   |
| Difference in cost (£)  | Mean -36.80  | Mean 35.23  | Mean 60.85  | Median 518.35  | Median 741.36   |
| Ratio of geometric mean (95% CI)  | 0.89 (0.73 to 1.09)                                    | 1.004 (0.82 to 1.22)                                    | 1.06 (0.98 to 1.23)                                   | —  | —   |
| p value   | 0.27   | 0.96  | 0.10  | 0.05   | 0.02  |
| Sensitivity analysis: length of stay in hospital at home care reduced by 1 day                |  |   |   |  |   |
| Difference in cost (£)  | Mean 58.32   | Mean -8.01  | Mean -21.75   | Median 227.25  | Median 840.26   |
| Ratio of geometric mean (95% CI)  | 1.02 (0.84 to 1.23)                                    | 1.002 (0.84 to 1.19)                                    | 0.99 (0.90 to 1.11)                                   | —  | —   |
| p value   | 0.87   | 0.99  | 0.99  | 0.17   | 0.04  |
| Sensitivity analysis: length of stay in hospital at home care reduced by 2 days               |  |   |   |  |   |
| Difference in cost (£)  | Mean 10.61   | Mean -49.10   | Mean -80.48   | Median 103.37  | Median 757.23   |
| Ratio of geometric mean (95% CI)  | 0.95 (0.78 to 1.15)                                    | 0.96 (0.81 to 1.15)                                     | 0.88 (0.78 to 0.99)                                   | —  | —   |
| p value   | 0.59   | 0.68  | 0.03  | 0.38   | 0.06  |

HaH = hospital at home.

chronic obstructive airways disease when duration of hospital at home care was reduced by one day, but a reduction of two days resulted in a non-significant difference between the two groups.

Using average hospital costs instead of dependency adjusted costs reduced the difference in cost between hospital at home care and hospital care for all groups of patients except for the elderly medical patients. Using standard general practitioner costs<sup>8</sup> for both arms of the trial altered the results only for patients recovering from a hip replacement, and general practitioner costs for these patients became significantly more expensive (Mann-Whitney *U* test,  $p = 0.03$ ).

## Discussion

Many believe that hospital at home schemes will contain health care costs by reducing the demand for acute hospital beds. Our findings indicate that this is not the case. Instead, hospital at home care increased health service costs for some groups of patients, while for others there were no net differences in costs. This is perhaps not surprising, as patients who were discharged early to hospital at home care went home when their hospital care was least expensive. Once in hospital at home care some patients, particularly elderly patients with a medical condition, required 24 hour care. Furthermore, hospital at home increased the overall duration of an episode of health care. This pattern has been observed elsewhere.<sup>4</sup> It may be possible to decrease the amount of time patients spend in hospital at home, and thus reduce cost. However, this could have an adverse effect on patient outcomes. For elderly medical patients and those with chronic obstructive airways disease, hospital at home care increased general practitioner costs, providing evidence that some costs were shifted within the health service.

Perhaps surprisingly for a service that is intended to reduce the pressure on acute hospital beds, the proportion of patients eligible for hospital at home care was low. Other evaluations have also described a relatively low volume of eligible patients.<sup>2,4,9-12</sup> This contrasts with the numbers described by some service providers (Harrison V, Intermediate Care Conference, Anglia and Oxford NHS Executive, Milton Keynes, October, 1997). An increased volume of patients would not, however, alter the costs substantially as only a small proportion of hospital at home costs are fixed. It is possible that patients who would otherwise agree to use hospital at home are deterred by an evaluation. An alternative explanation may be that hospital at home provides extra care in the community but not necessarily care that would otherwise be carried out in a hospital setting.

Just as inappropriate admissions are a problem for acute hospitals, there is no reason to believe they do not pose a problem for services such as hospital at home. We found that some patients allocated to hospital care were never admitted to hospital and stayed at home with no extra services. This has been found elsewhere (A. Wilson, personal communication) and suggests that hospital at home schemes could potentially provide care to patients who would otherwise not be receiving health care services. Alternatively, hospital at home may be viewed as supplementing existing services, which may be an acceptable policy option for some groups of patients, particularly elderly medical patients who prefer this form of care.

The extent to which hospital at home care can substitute for hospital care in the United Kingdom is limited. This can partly be explained by the speed at which hospital at home schemes have been set up. Purchasers and providers have

responded, quickly to initiatives, usually supported by 'ring fenced' monies, designed to ease the pressure on hospital beds. Schemes have usually been grafted onto primary care services, with minor alterations to the mix of skills already available. They may become out of date with changes in hospital practice. This is a particular problem for schemes admitting patients who are discharged early from hospital. As hospital lengths of stay decrease, the number of days that can be transferred into the community is correspondingly reduced.

### Conclusions

The results of this trial suggest that simply shifting services from one location to another is unlikely to reduce health service costs. Patients discharged early after elective surgery go home at a time when they use least resources. When an inpatient stay involves relatively high nursing costs, as with elderly medical patients, early discharge to hospital at home is unlikely to be significantly cheaper than hospital based care as most of these nursing costs still have to be incurred. Hospital at home care may be cost effective for patients who are relatively independent but who require technical support, such as those receiving intravenous antimicrobial therapy. However, there is little evidence to support or refute this.<sup>13</sup> Service developments, as much as clinical interventions, need to be evidence based. Arguments for diverting resources away from hospital beds should be viewed in the light of the available evidence.

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### What you might do now

