Protocol

Title

Cost-effectiveness of models of care for young people with eating disorders (CostED)

Research team

Principal investigator

Professor Sarah Byford, King's College London

Trial managers

Dr Hristina Petkova, King's College London

Dr Nuala Livingstone, Queen's University Belfast

Co-investigators

Professor Ivan Eisler, King's College London

Dr Dasha Nicholls, Great Ormond Street Hospital

Professor Simon Gowers, University of Liverpool

Dr Barbara Barrett, King's College London

Susan Ringwood, Beat (Beating Eating Disorders)

Professor Geraldine Macdonald, Queen's University, Belfast

Professor Fiona McNicholas, Our Lady's Children's Hospital, Dublin

Dr Tamsin Ford, University of Exeter

Dr Mima Simic, South London and Maudsley NHS Trust

Dr Robin Glaze, Abergele Hospital

Jo Fletcher, South London and Maudsley NHS Trust

Summary of amendments

Amendment	Reason	Date	Version
CGAS added as an outcome measure	More commonly used in clinics	01/11/13	v1.1
Follow-up reduced from 9 and 18 months to 6 and 12 months	Delays in approvals and concerns from CAPSS about burden on clinicians and likelihood of remaining in contact	07/03/14	v1.1
Start and end dates corrected in the Plan of Investigation and Timetable section	Incorrect dates entered in previous version	06/01/15	v1.2

Background

Anorexia nervosa (AN) is a severe and enduring mental health problem with an annual incidence in the most vulnerable group (adolescent girls aged 15-19 years) of between 110-135 per 100,000.[1,2] AN is commonly associated with severe physical, psychological and social impairments, high levels of mortality[3] and a significant cost burden.[4,5] Although the majority of adolescents with AN eventually recover, the illness is often protracted, with a mean duration of 5-6 years.[6] Because AN is potentially life threatening, a significant proportion of young people with AN will be treated as inpatients in hospital. Nationally 35% or more adolescents with AN [7] and over 50% of children with AN [8] are admitted to hospital at some point. The number of admissions to hospital for eating disorders in under 14s rose consistently over the decade between 2000 and 2010,[9] and children under 18 now account for more than one in three hospital stays for eating disorders. Although some admissions (mainly on paediatric wards) are brief, many are as long as 6-12 months and in some cases longer. Hospital admission is disruptive to school, family and social life and relapse rates for inpatient treatment are high (25-30% after first admission and 50-75% after subsequent admission),[6,10] with evidence that clinical outcomes may be worse even when severity is accounted for.[11] In contrast those who have responded well to outpatient family therapy have low relapse rates of 5-10%.[12-14]

There are two main community-based care pathways for young people with AN. The first and most common is from primary care to a generic, local child and adolescent mental health service (CAMHS) that will have varying levels of expertise in eating disorders and a variable mix of individual or family-based treatments. In some cases, this may include a specific eating disorders "mini-team". The second referral route is from primary care directly to a specialist outpatient child and adolescent eating disorder service (CAEDS). These are tertiary level dedicated, multidisciplinary services that cover a larger geographical area than a single CAMH service and have been reported to reduce rates of admission to hospital by as much as 60-80%.[15] Although these have been growing in number in recent years, they are still relatively rare in the British Isles.

There is limited service level research in eating disorders comparing the relative benefits of different care pathways for young people with AN. One study, the Treatment Outcome for Child and Adolescent Anorexia Nervosa (TOuCAN) trial, which compared brief treatment in a specialist service with treatment as usual in CAMHS and inpatient treatment, found no differences in clinical outcomes [16] but a significant difference in cost favouring the specialist service.[17] All groups made considerable progress at one year, with further improvement by two years, though full recovery rates were low. Although neither inpatient nor specialist outpatient treatment demonstrated statistically significant advantages over general CAMHS care, initial inpatient treatment predicted poor outcomes and did not provide advantages over outpatient management. Importantly, in those cases where outpatient treatment had failed and the young person was transferred to inpatient facilities, the outcome was poor. On the basis of the cost-effectiveness analysis, the study concluded that specialist outpatient treatment had the highest probability of being the most cost-effective treatment strategy.[17]

A London based study [18] compared areas with CAED services accepting direct referrals from GPs with areas with no such services, where treatment would normally be offered in generic CAMHS with further referral (to inpatient or specialist outpatient) if deemed necessary. The study found three key differences between these care pathways. First, case identification of adolescent AN in specialist areas was high, approximately at a level predicted by epidemiological studies, suggesting that the services were largely meeting the actual need in the community. In non-specialist areas, rates of referrals were more than 50% lower. Second, there were significant differences in the rates of admission to hospital between those whose treatment started in a specialist service (16%) and those first treated in generic CAMHS (40%). Third, there were differences in the continuity of care. For a young person whose treatment was initiated in a specialist outpatient service, 83% received all their care from the same team. By contrast, those assessed initially in generic CAMHS, continued treatment in the service without further referral in only 20% of cases. This lack of continuity of care was identified as a key problem by parents who took part in a qualitative exploration of experience of care.[19] Although the results in boroughs with specialist eating disorders "mini-teams" were variable, in general they were more comparable to specialist CAED teams than to generic non-specialist CAMHS.

Despite these findings, many parts of the British Isles have little or no specialist eating disorder provision for young people. The available evidence suggests that, if the above findings are generalized, investing in the development of such services could have significant implications for the NHS, with the potential to improve health outcomes through reductions in relapse rates, to reduce costs through reductions in hospital admission, and to improve the quality of life of young people. However, service commissioners are unlikely to support increased investment in specialist services at a time when disinvestment is more pressing. Clear evidence of the savings to be made from investment is therefore needed, alongside evidence that patient and family outcomes will be enhanced or at least no worse than the current situation. The proposed work aims to provide such evidence through the exploration of the cost and cost-effectiveness of existing community-based models of service provision in the British Isles.

Aims and objectives

This study aims to evaluate the cost and cost-effectiveness of existing community-based models of service provision for child and adolescent anorexia nervosa (AN) and to model the impact of potential changes to the provision of specialist NHS services using decision analytic modelling techniques.

The objectives of the study are:

1) To identify all new community-based incident cases of AN in young people aged 8-18 in the British Isles over a 12-month period using a psychiatric surveillance system;
2) To classify the model of community-based care provided for each case identified at baseline and map models of care across the British Isles using a brief questionnaire to reporting clinicians;
3) To calculate the relative cost of all incident cases of child and adolescent AN in England, Wales and Northern Ireland and determine the cost and cost-

effectiveness of different models of care provision at 6-month and 12-month follow-up through questionnaires to reporting clinicians;
4) To explore the impact on cost and cost-effectiveness of potential changes to the provision of specialist services in England, Wales and Northern Ireland using decision analytic modelling techniques.

The hypotheses of the study are that:

1) Assessment and treatment by highly specialist or tertiary specialist community-based eating disorder services for child and adolescent AN in England, Wales and Northern Ireland will be less costly to the health service over 12-months than assessment and treatment by or referral via generic (non-specialist) child and adolescent mental health services (CAMHS) or eating disorder teams located within generic community CAMHS.
2) Assessment and treatment by highly specialist or tertiary specialist community-based eating disorder services for child and adolescent AN in England, Wales and Northern Ireland will be more cost-effective from the health service perspective over 12-months than assessment and treatment by or referral via generic (non-specialist) CAMHS or eating disorder teams located within generic CAMHS.
3) Increasing the availability of highly specialist or tertiary specialist community-based eating disorder services for child and adolescent AN in England, Wales and Northern Ireland will be cost-saving to the health service over the medium to long-term.

Methods

Study design

The study will involve the development of a decision analytic model to explore the impact of potential changes to the configuration of community-based services for child and adolescent AN on relative cost and cost-effectiveness.

Sampling

The model will be populated with data on all incident cases of child and adolescent AN in England, Wales and Northern Ireland, collected over a 12-month period via a naturalistic surveillance study using the Child and Adolescent Psychiatric Surveillance System (CAPSS).[20] CAPSS is a system designed to ascertain cases of rare childhood mental health conditions which relies on non-consent to maximise accuracy of incidence data. CAPSS aims to facilitate epidemiological surveillance and research into uncommon child and adolescent mental health conditions, increase awareness within the medical profession and public alike of the less common psychiatric disorders that afflict children and allow psychiatrists to participate in surveillance of such conditions.

CAPSS uses a report card, known as the yellow card, which contains a list of conditions being surveyed. The yellow card, along with reporting instructions and protocols for new studies, is sent every month to a mailing list of all hospital, university and community paediatric consultant psychiatrists who are members of the Royal College of Psychiatrist or respective Irish colleges, currently totalling 1000 respondents. The aim is to involve every senior doctor who is likely to have clinical

responsibility for children with rare conditions. The reporting clinicians are sent yellow cards from the CAPSS office and asked to check boxes against any of the reportable conditions they have seen in the preceding month, or to check a "nil return" box if none have been seen, and return the card to the CAPSS office. A tear-off slip is provided with the card for the psychiatrists to keep a convenient record of patients reported. "Positive" returns are identified by the CAPSS administrator and then notified to the appropriate research investigator, who then contacts the reporting clinician directly to request completion of a brief data collection form.

CAPSS uses an inclusive system which covers the whole of the UK and Eire. Whilst the focus of the NIHR HS&DR is on England and Wales, the collection of CAPSS data from specific regions or countries within the British Isles is not encouraged and open to error. Instead, baseline data from incident cases will be collected from the whole of the British Isles (Objective 1) and used to support the classification of models of community-based care and the mapping of models of community-based service provision (Objective 2). However, follow-up data to calculate the cost and cost-effectiveness of different models of community-based service provision (Objective 3) and to populate the decision analytic model (Objective 4) will be collected only from those cases reported in England and Wales, plus Northern Ireland which is funded separately. The option to collect follow-up data from the rest of the British Isles will be retained as a contingency plan should recruitment be lower than expected.

Setting/context
The proposed work is focused on community-based health services for child and adolescent AN. However, a substantial proportion of cases are admitted to hospital at some point during the course of their illness so the setting will cover both community-based and hospital-based secondary and tertiary mental health services.

Inclusion and exclusion criteria
Children and adolescents aged 8-18, in contact with community-based mental health services for a first episode of AN, according to DSM-V criteria.[21] Cases currently in secondary or tertiary inpatient facilities will be included in the incidence and service mapping objectives (objectives 1 and 2) but excluded from the follow-up study (objectives 3 and 4), although these cases will be eligible for inclusion if they are subsequently notified after discharge to community services. We will also exclude cases of young people whose clinician-reported data is insufficient to assess eligibility or duplicate cases, that have been notified more than once by the same or different clinicians.

Sample size
For the survey (Phase 1 of the study), the concept of a ‘sample size’ (which allows inferences to be made about the population as a whole) is not helpful since we are aiming to collect population level data. The aim is to identify *all* incident cases of anorexia nervosa in the UK and Eire over a 12-month period, in order to come to conclusions in relation to the population, rather than making inferences about the population from a smaller sample.

Phase 2 of the study involves decision analytic modelling to support real-world decisions relating to the configuration of community-based services for child and

adolescent AN. Decision-analytic modelling is a systematic approach to decision making which aims to inform decisions under conditions of uncertainty. Issues of statistical significance are unhelpful in this context. Instead, a decision-making approach is advocated which attempts to make the most of the data available by focusing less on issues of statistical significance and more on the probability of one intervention or service configuration being more cost-effective than another, given the data available, rather than undertaking what is likely, given low prevalence rates in AN, to be a prohibitively large RCT.[22]. The TOuCAN study, for example, was a large multi-centre, population based study including the majority of cases in the entire North West region of the UK.[16,17] Yet despite large differences in cost between the three included groups, these differences were not found to be statistically significant, suggesting inadequate power and thus an inadequate sample size. Any attempts to increase the sample size would be extremely difficult and would need to involve additional regions, not just additional centres.

From a statistical point of view, commentators stress that the absence of evidence is not evidence of absence.[23] Similarly, from a decision-making point of view, the perversity of ruling out an intervention which has the highest probability of being cost-effective has been highlighted as a limitation of conventional hypothesis testing.[24,25] Although observed differences may indeed be the result of chance, a decision still has to be made and these authors argue that it is better to use the available evidence than to dismiss it on the basis of an arbitrary decision rule. It should then be left to the decision-maker to assess the quality of the available evidence and decide whether or not there is a need for further information. In the meantime, the decision-maker would do better to select the intervention with the highest probability of being cost-effective, than to simply maintain the status quo. This is the approach taken in this proposal. The following provides estimates for expected baseline and follow-up rates.

Primary care estimates

Primary care based data for anorexia nervosa collected in the UK between 1994 and 2000 reported incidence rates for children and adolescents aged between 10 to 19 of 34.6 per 100,000 for females and 2.3 per 100,000 for males.[26] For children aged 0 to 9, the incidence rate was zero. More recent UK estimates for young people aged 10 to 19 indicate a small increase in incidence rates to 37.1 per 100,000 for females and 3.2 per 100,000 for males.[27] We applied these more recent estimates, broken down by age and gender where possible, to population data for the UK and the Republic of Ireland [28,29] for young people aged between 10 and 18 (the maximum age included in the proposed study). Estimates for younger children were only available from the earlier study.[26] The results are reported in Table 1. These incidence rates suggest an estimated number of new cases of AN in primary care in the British Isles over a 12-month period of 1329 (approximately 1215 females and 115 males).

Table 1: Incidence estimates from primary care data

Age	Gender	Incidence	Population by age		Number of cases		Total	Source
			UK	RoI	UK	RoI		
8-9	Both	0.00	1,333,900	126,416	0	0	0	[26]
10-14	Female	24.00	1,741,600	147,415	418	35	453	[27]
10-14	Male	2.50	1,825,400	155,076	46	4	50	[27]
15-18	Female	47.50	1,494,000	110,237	710	52	762	[27]
15-18	Male	3.80	1,581,800	115,700	60	4	65	[27]
Total							1329	[27]

Secondary care estimates

Data from secondary care studies are more limited. Data from a London care pathways study [18] suggests an incidence rate of 54.6 for young women aged between 13 and 18, including anorexia nervosa and EDNOS-AN, a proportion of which is now classified as anorexia nervosa under DSM-V. Data for young men was not reported as the numbers were so small. For the younger ages, data is available from a British national surveillance study carried out in 2005/2006 using the CAPSS system.[8] Application of these rates to UK and Republic of Ireland population data [28,29] is reported in Table 2, broken down by age and gender where data allowed. For males aged 13 to 18, primary care rates have been used due to the lack of secondary care data for this group.[27] These incidence rates suggest an estimated number of new cases of anorexia nervosa in the British Isles over a 12-month period of 1435, slightly higher than the primary care estimate, above. However, given that the majority of these cases were estimated using London data,[18] we have adjusted these figures downwards to take into account the fact that the incidence rates in London may be higher than the British Isles more broadly as a result of the greater concentration of specialist eating disorder services in London. We have reduced the London incidence rate by 10% and by 20%, as shown in Table 2.

Table 2: Incidence estimates from secondary-care data

Age	Gender	Incidence	Population		Number of cases		Total	Source
			UK	RoI	UK	RoI		
8	Total	0.00	666,300	63,581	0	0	0	[8]
9	Total	0.72	667,600	62,386	5	0	5	[8]
10	Total	1.42	683,300	61,181	10	1	11	[8]
11	Total	1.69	703,100	60,587	12	1	13	[8]
12	Total	3.63	715,500	60,926	26	2	28	[8]
13-18	Female	54.60	2,208,700	168,213	1206	92	1298	[18]
13-14	Male	2.50	750,300	61,018	19	2	20	[27]
15-18	Male	3.80	1,581,800	115,700	60	4	65	[27]
Total							1440	
London incidence rate reduced by 10%							1310	
London incidence rate reduced by 20%							1180	

Approach taken

The estimates presented suggest a total population of new cases of AN in secondary care of between 1,200 and 1,400 per annum. Using data from the previous British national surveillance study,[8] we have calculated the following expected rates of case

notification at baseline and response rates at follow-up, dependent on whether new cases are the higher or lower of these estimates:

Table 3: Expected rates of case notification and follow-up over 12-months

	Lower estimate	Higher estimate
Baseline notifications:		
Expected new cases in UK & RoI a 12-month period	1200	1400
75% referred by psychiatrists (excludes paediatricians)	900	1050
85% of all psychiatrists expected to report	765	893
Plus 15% expected duplications[1]	880	1026
Follow-up rates:		
Expected new cases excluding duplicates	765	893
90% with sufficient data to assess eligibility[2]	650	759
80% with no reporting errors[3]	520	607
92% England, Wales & Northern Ireland for follow-up	478	558
85% response rate at first follow-up	407	474
75% response rate at second follow-up	305	356

[1] We assumed 15% for duplicates; 31% duplicates were reported in the British national surveillance study however this included both paediatricians and psychiatrists, thus increasing the likelihood of duplicate notifications
[2] We assumed 15% exclusion due to insufficient data as reported in the national surveillance study
[3] We assumed 20% exclusion due to reporting errors – 29% reported in national surveillance study however we plan to contact clinicians by telephone to minimise this so lower rate applied (n=864)

Limitations of the approach

There is limited evidence of incidence rates of AN in secondary care settings – the setting of interest to the current study. Most evidence uses data from primary care or, in the case of the British National Surveillance Study which based estimates on CAPSS notifications,[8] focuses on younger children than we plan to include (under 13s). The estimates presented here are primarily based on one London study,[18] which may not accurately reflect the rest of the British Isles. Our adjustments for the likely over-estimate within a London sample are not evidence-based and thus may not be accurate.

In addition, the London study includes both AN and EDNOS-AN, according to DSM-IV diagnostic criteria. However new DSM-V definitions of anorexia nervosa include a large proportion of what used to be known as EDNOS-AN.[21] The size of this group is currently unknown. We have therefore assumed it to be 100% (i.e. all EDNOS-AN defined by DSM-IV is classified as anorexia nervosa using DSM-V), so the expected number of notifications presented here may be an over-estimate. The figures presented should therefore be considered the maximum expected.

Baseline data – UK and Eire

Upon notification from the CAPSS system of a new case of child and adolescent AN, the notifying clinician will be sent a brief questionnaire to confirm eligibility of the case and to support the categorisation of the model of service delivered and the geographical mapping of models of care across the British Isles. Classification will focus on the service undertaking the initial assessment. Classifications will be refined as part of the study, however we anticipate a classification system based on the following criteria:

- Tertiary specialist child and adolescent eating disorder service (CAEDS) containing a trained, multi-disciplinary team, including medical and non-medical staff, and more than one person with experience of treating eating disorders, with the necessary expertise to deliver recommended treatments for adolescents (i.e. psychological therapy, assessment of physical risk and family interventions addressing the eating disorder), and having resources required to offer routine outpatient treatment for a minimum of 25 cases per year.[30] CAED services cover larger geographical areas than a single CAMHS
- Specialist CAMHS teams based in a generic secondary care CAMHS but containing a specialist eating disorder component. These teams operate within a single CAMHS setting, have a more limited multidisciplinary input and a smaller throughput of eating disorder cases than CAEDS.
- Generic secondary (non-specialist) CAMHS services.

Following initial mapping of services we will convene an independent expert group using Delphi methodology to help specify an operational definition for specialist teams in order to differentiate them clearly from non-specialist CAMHS teams.

Follow-up data – England, Wales and Northern Ireland
Six months and 12-months after notification, the notifying clinician and/or the notifying service will be re-contacted by phone to collect anonymised information on the following:

Health service use
Health service use since notification, including frequency and length of inpatient admissions and number of hospital or community based outpatient contacts. Whilst this is a narrow cost perspective, excluding broader health, social and education services, two year total costs in the TOuCAN study which took a societal perspective, were found to be heavily dominated by hospital costs and CAMHS community outpatient costs.[17] Together, inpatient and outpatient costs were found to account for over 90% of total two-year costs.[31] Thus, a narrow perspective will minimise respondent burden, and allow us to take advantage of surveillance methodology which traditionally does not involve direct patient contact, whilst still providing evidence of the key costs in this population.

Outcomes
Whilst costs are the primary variable of interest in the proposed work, measures of effectiveness will also be collected to confirm previous evidence from treatment trials to suggest specialist treatments are at least as effective as standard care and to provide up to date evidence for inclusion in the economic modelling component of the study. Outcome data will be collected from treating clinicians and assessed in terms of key indicators, including age adjusted percentage median body mass index (BMI), Health of the Nation Outcome Score for Children and Adolescents (HoNOSCA), a routine outcome measurement tool that assesses behaviours, impairments, symptoms, and social functioning of children and adolescents with mental health problems,[32] outcome category according to the Morgan and Russell criteria, a widely used measure of outcome for anorexia nervosa,[33] and the Children's Global Assessment Scale (CGAS), used to rate the emotional and behavioural functioning of children and

adolescents in the family, school, and social context, and designed for use in telephone interviews with treating clinicians.[34]

Analysis

Incidence of child and adolescent AN

Assessment of the current incidence of AN in children and adolescents aged 8 to 18 in the British Isles will be primarily descriptive. Where duplicates are reported, data will be used from the most complete data-set, or the data-set received closest to the reporting date. Incidence will be calculated as number of cases as a proportion of the total number of children of that age in the population (UK plus ROI) expressed as per 100,000 population. Total population data for children and adolescents aged 8–18 will be obtained from the Office of National Statistics (UK) and the Central Statistics Office (Ireland).[28,29] The incidence rates calculated will update evidence from previous studies, now over ten years old,[26] and fill the gap in the literature relating to older young people, given more recent research (2005 to 2006) focused only on early onset eating disorders (<13 years of age).[8]

Cost of child and adolescent AN

Data on inpatient and outpatient health service contacts from the surveillance study will be used to calculate the 12-month cost of all cases followed-up in England, Wales and Northern Ireland and to assess the relative cost of alternative community-based models of service provision. Costs for NHS hospital contacts will be taken from NHS reference costs.[35] Mean costs for each model of service, as categorised at baseline, will be compared using standard parametric tests and the robustness of the results confirmed using bootstrapping, despite the skewed nature of cost data.[36] The advantage of this approach, as opposed to logarithmic transformation or non-parametric tests, is the ability to make inferences about the arithmetic mean, which is more meaningful from a budgetary perspective.[37]

Cost-effectiveness of models of care for child and adolescent AN

Individual level cost and outcome data will be used to calculate the relative cost-effectiveness of the alternative community-based models of service provision at the 12-month follow-up point. Cost-effectiveness will be assessed using the net benefit approach.[38] Uncertainty around the cost and effectiveness estimates will be represented by cost-effectiveness acceptability curves.[39,40] A joint distribution of incremental mean costs and effects for the two groups will be generated using non-parametric bootstrapping to explore the probability that each treatment is the optimal choice, subject to a range of possible maximum values (ceiling ratio) that a decision-maker might be willing to pay for an additional unit of outcome gained. Cost-effectiveness acceptability curves will be presented by plotting these probabilities for a range of values of the ceiling ratio.[41] These curves are a recommended decision-making approach to dealing with the uncertainty that exists around the estimates of expected costs and expected effects associated with the interventions under investigation and uncertainty about the maximum cost-effectiveness ratio that a decision-maker would consider acceptable.[41,42] Cost-effectiveness will be measured in terms of the clinician-rated HoNOSCA,[32] and confirmed using age adjusted BMI, data which is likely to be available for a greater proportion of the population.

Decision analysis

Data from the surveillance study will be used to populate a decision analytic model to estimate the impact on cost and cost-effectiveness of changes to the configuration of specialist NHS services, and the potential for cost savings. Decision analysis is a structured way of thinking about the likely impact of a decision or policy change and involves the construction of a logical model to represent the relationship between inputs (costs) and outputs (outcomes) in order to inform resource allocation decisions under conditions of uncertainty.[43] Decision models use mathematical relationships to define possible consequences that flow from a set of alterative options being evaluated.[44] Each pathway in a decision model is associated with a probability, an outcome and a cost, where the latter is the sum of the costs of each of the events an individual experiences in that pathway. Once constructed, the assumptions and the data used in the model can be varied to explore a range of scenarios.

Rather than waiting for the results of a formal evaluation, in decision analysis resource allocation is explored by modelling existing data on costs, outcomes and probabilities from a range of possible sources including completed studies, from the literature or from expert opinion, to generate more timely results. In the proposed model, data will primarily come from the naturalistic study. Models are useful because once constructed, the assumptions and the data used in them can be amended as more relevant or up-to-date information becomes available. Models can also be used to explore 'what if' scenarios, so providing information to decision makers on the likely impact of changes to the services, such as changes in treatment length, personnel or capacity.

We will select the most suitable modelling framework in which to carry out the analysis, dependent upon the results of the naturalistic study. In cases where individuals can be regarded as independent and interaction between them is not an issue in terms of the course or progression of an illness, as is the case with eating disorders, either a decision tree or a Markov model is appropriate.[45] Decision trees are limited by their fairly simplistic representation of reality and they can often become unwieldy as attempts are made to make them sufficiently complex to model real-world scenarios. A Markov model may provide a useful alternative since they are better able to deal with more complicated structures and are often used when costs and outcomes need to be considered over longer periods of time.

The decision model constructed for this evaluation will compare the costs and outcomes of the alternative service routes for children and adolescents with AN described above (assessment and referral via a specialist eating disorder service, a specialist CAMHS service or a generic CAMHS service). The decision model will depict the progress of a young person with AN through different service pathways and will require data on the probabilities of progression from one stage to another and the costs and outcomes associated with each stage. As far as possible, these variables will be taken from the data collected in the naturalistic study. However, in the event of gaps in the cost, effectiveness or probability data from the naturalistic study, supplementary data will be taken from the TOuCAN study, which collected comprehensive cost and outcome data on 167 adolescents with AN over a two-year period, or other published evaluations from the literature, as appropriate. It is not anticipated that a full systematic review will be required to locate suitable studies, since the economic literature in eating disorders is limited, however searches for

recently completed or available evidence may be necessary and will be dependent on the extent of gaps in the naturalistic surveillance study.

The cost-effectiveness of the alternative service routes will be analysed using incremental analysis and probabilistic sensitivity analysis. It is necessary for models to build in uncertainty estimates for the probability, cost and outcome parameters used. In this model it is likely that variability, heterogeneity and uncertainty will be important and will therefore need to be incorporated. Because many of the model parameters will be based on real data from the naturalistic study, it will be possible to use regression models and appropriate assumptions regarding the statistical distribution of the data to handle the uncertainty.[44] The model will initially be run over 12-months, in line with the data to be collected. However, secondary analysis will explore a five-year time frame using data from the TOuCAN study five-year, long-term follow-up.[46] There will also be opportunities in the modelling work to explore the relative cost-effectiveness for sub-groups, such as younger and older age groups or different geographical locations (i.e. rural versus urban settings).

Once the model has been developed and populated, it will be used to calculate the potential cost savings that could occur as a result of any service re-configuration. For example, if cost-effectiveness analysis suggests specialist outpatient care results in cost savings, the model will be used to calculate the money that could be saved by a health care region by switching over to this type of service.

Ethical approvals

The study requires approval from CAPSS and approval from the Health Research Authority (HRA) Confidentiality Advisory Group (CAG) for exemption from obtaining participant consent, under Section 251 of the NHS Act 2006, which enables disclosure of confidential patient information where it is not possible to use anonymised information and where seeking consent is not practical. Application to the HRA CAG has been approved, subject to compliance with the standard and specific conditions of approval (CAG 4-03(PR1)/2014), and a Phase 2 application to CAPSS is currently being revised following comments from the CAPSS Executive Board.

Plan of investigation and timetable

Start date: 1st June 3013
End date: 30th November 2016
Duration: 42 months

Months 1-12: Submit applications for ethical approval and CAPSS approval; draft trial protocol; design CAPSS notification card and baseline questionnaire; recruit trial manager (London); recruit trial manager (Belfast)

Months 13-24: CAPSS surveillance notification phase; recruit part-time research workers; design database; first Delphi panel and initial categorisation of notifying services

Months 19-30: First follow-up; second Delphi panel and final categorisation of notifying services; analysis of incidence from baseline data

Months 25-36: Second follow-up; costing and analysis of first follow-up data; design and test decision model

Months 37-42: Costing and analysis of second follow-up data; populate and run decision model; draft final report and publications

References

[1] Lucas AR, Crowson CS, et al. The ups and downs of anorexia nervosa. International Journal of Eating Disorders, 1999, 26(4), 397-405.

[2] van Son GE, van Hoeken D, et al. Time trends in the incidence of eating disorders: a primary care study in the Netherlands. International Journal of Eating Disorders, 2006, 39(7), 565-569.

[3] National Collaborating Centre for Mental Health. Eating disorders: core interventions in the treatment and management of anorexia nervosa, bulimia nervosa and related eating disorders. Leicester: British Psychological Society, 2004.

[4] Striegel-Moore RH, Leslie D, et al. One-year use and cost of inpatient and outpatient services among female and male patients with an eating disorder. International Journal of Eating Disorders, 2000, 27(4), 381-389.

[5] Simon J, Schmidt U, Pilling, S. The health service use and cost of eating disorders. Psychological medicine, 2005, 35, 1543-1551.

[6] Strober M, Freeman R, et al. The long-term course of severe anorexia nervosa in adolescents. International Journal of Eating Disorders, 1997, 22(4), 339-360.

[7] National CAMHS Audit, 2002. http://www.dur.ac.uk/camhs.mapping

[8] Nicholls DE, Lynn R, Viner RM. Childhood eating disorders: British national surveillance study. British Journal of Psychiatry, 2011, 198, 295-301.

[9] NHS Information Centre for Health and Social Care. Provisional monthly hospital episode statistics for admitted patient care, outpatient and accident & emergency data: September 2010 - August 2011. http://www.ic.nhs.uk/news-and-events/news/one-in-three-hospital-stays-for-eating-disorders-are-among-children-say-new-figures.

[10] Lay B, Jennen-Steinmetz C, et al. Characteristics of inpatient weight gain in adolescent anorexia nervosa: relation to speed of relapse and re-admission. European Eating Disorders Review, 2002, 10, 22-40.

[11] Gowers SG, Weetman J, et al. Impact of hospitalisation on the outcome of adolescent anorexia nervosa. British Journal of Psychiatry, 2000, 176(2), 138-141.

[12] Eisler I, Simic M, et al. A randomised controlled treatment trial of two forms of family therapy in adolescent anorexia nervosa: a five-year follow-up. Journal of Child Psychology and Psychiatry, 2007, 48(6), 552-560.

[13] Eisler I, Dare C, et al. Family and individual therapy in anorexia nervosa: a 5 year follow-up. Archives of General Psychiatry, 1997, 54(11), 1025-1030.

[14] Lock J, Couturier J, et al. Comparison of long-term outcomes in adolescents with anorexia nervosa treated with family therapy. Journal of the American Academy of Child and Adolescent Psychiatry, 2006, 45(6), 666-672.

[15] Berelowitz M. Management of anorexia nervosa revisited: the emphasis needs to continue to shift to outpatient care. British Medical Journal, 2004, 328, 1075.

[16] Gowers SG, Clark A, et al. Clinical effectiveness of treatments for anorexia nervosa in adolescents: randomised controlled trial. British Journal of Psychiatry, 2007, 191, 427-435.

[17] Byford S, Barrett B, et al. Economic evaluation of a randomised controlled trial for anorexia nervosa in adolescents. British Journal of Psychiatry, 2007, 191, 436-440.

[18] House J, Schmidt U, et al. Comparison of specialist and non-specialist care pathways for adolescents with anorexia nervosa and related eating disorders. International Journal of Eating Disorders, 2012, 45(8), 949-56.
[19] House J. Service Utilisation and Alternative Care Pathways for Adolescents with Anorexia Nervosa and Related Eating Disorders. PhD Thesis, Kings College, University of London, 2010.
[20] Child and Adolescent Psychiatry Surveillance System. http://www.rcpsych.ac.uk/quality/research/capss1.aspx
[21] American Psychiatric Association. DSM5: the future of psychiatric diagnosis. http://www.dsm5.org/Pages/Default.aspx.
[22] Briggs A. Handling uncertainty in economic evaluation and presenting the results, in Economic evaluation in health care: merging theory and practice, M. Drummond & A. McGuire, eds., London: Gaskell, 2001, 172-214.
[23] Altman DG & Bland JM. Absence of evidence is not evidence of absence. British Medical Journal, 1995, 311, 445.
[24] Claxton K. The irrelevance of inference: a decision-making approach to the stochastic evaluation of health care technologies. Journal of Health Economics, 1999, 18, 341-364.
[25] Claxton K, Sculpher M, Drummond M. A rational framework for decision making by the National Institute for Clinical Excellence (NICE). Lancet, 2002, 360, 711-715.
[26] Currin L, Schmidt U, et al. Time trends in eating disorder incidence. British Journal of Psychiatry, 2005, 186(2), 132-135.
[27] Micali N, Hagberg KW, et al. The incidence of eating disorders in the UK in 2000-2009: findings from the General Practice Research Database. BMJ Open, 2013, 2, e002646. doi:10.1136/bmjopen-2013-002646.
[28] Office for National Statistics. Mid-2011 Population Estimates: United Kingdom; estimated resident population by single year of age and sex. www.ons.gov.uk.
[29] Central Statistics Office. Population by age last birthday, at each year of age, sex and census year, 2011. www.cso.ie.
[30] Royal College of Psychiatry. Eating disorders in the UK: policies for service development and training. London: Royal College of Psychiatrists, 2000.
[31] Byford S. The design of clinical and economic evaluations of child and adolescent mental health services in the UK: policy and practice. PhD Thesis, King's College London, 2009.
[32] Gowers S.G., Harrington R., et al. A brief scale for measuring the outcomes of emotional and behavioural disorders in children: HoNOSCA. British Journal of Psychiatry, 1999, 174, 413-416.
[33] Morgan HG & Hayward AE. Clinical assessment of anorexia nervosa. The Morgan-Russell Outcome Assessment Schedule. British Journal of Psychiatry, 1988, 152, 367-372.
[34] Shaffer D, Gould MS, et al. A Children's Global Assessment Scale (CGAS). Archives of General Psychiatry, 1983, 40(11), 1228-1231.
[35] Department of Health. NHS Reference Costs. London: Department of Health, 2011.
[36] Efron B, Tibshirani RJ. An introduction to the bootstrap. New York: Chapman & Hall, 1993.

[37] Barber JA & Thompson SG. Analysis of cost data in randomized trials: an application of the non-parametric bootstrap. Statistics in Medicine, 2000, 19, 3219-3236.
[38] Stinnett AA & Mullahy J. Net health benefits: a new framework for the analysis of uncertainty in cost-effectiveness analysis. Medical Decision Making, 1998, 18(2Suppl), S65-S80.
[39] Van Hout BA, Al MJ, et al. Costs, effects and C/E-ratios alongside a clinical trial. Health Economics 1994, 3, 309-319
[40] Fenwick E & Byford S. A guide to cost-effectiveness acceptability curves. British Journal of Psychiatry, 2005, 187, 106-108.
[41] Fenwick E, Claxton K, et al. Representing uncertainty: The role of cost-effectiveness acceptability curves Health Economics, 2001, 10(8), 779-87l
[42] Claxton K. The irrelevance of inference: a decision-making approach to the stochastic evaluation of health care technologies. Journal of Health Economics, 1999, 18(3), 341-64.
[43] Phillips Z, Ginnelly L, et al. Review of guidelines for good practice in decision-analytic modelling in health technology assessment. Health Technology Assessment, 2004, 8(36).
[44] Briggs A, Sculpher M, Claxton K. Decision analytic modelling for health economic evaluation. Oxford: Oxford University Press, 2006.
[45] Barton P, Bryan S, Robinson S. Modelling in the economic evaluation of health care: selecting the appropriate approach. Journal of Health Services Research and Policy, 2004, 9(2), 110-8
[46] Gowers SG, Clark AF, et al. A randomised controlled multi-centre trial of treatments for adolescent anorexia nervosa including assessment of cost-effectiveness and patient acceptability–the TOuCAN trial. Health Technology Assessment, 2010, 14(15).