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Maximising engagement, motivation and long term change in a Structured Intensive Education Programme in Diabetes for children, young people and their families: Child and Adolescent Structured Competencies Approach to Diabetes Education (CASCADE)

Summary
CASCADE aims to establish effective delivery and cost effectiveness of a structured intensive education programme using psychological approaches that maximise engagement, motivation and long-term change. A developmentally appropriate curriculum will teach adaptation of insulin dosage, normal eating and management of day to day challenges (e.g. exercise, illness) enabling flexible self management in diverse diabetes regimens. Children and young people (8-16 years) will complete the programme with their families. The primary outcome **(s)** will be glycosylated haemoglobin (HbA1c) levels 12 months and 24 months after recruitment. Secondary out-comes will include hospital admissions, hypoglycaemic episodes, self-efficacy, diabetes specific quality of life measures, family functioning and measures of emotional and behavioural adjustment 12 and 24 months post recruitment. Health economic modelling will establish the cost effectiveness of the intervention and its applicability to the wider NHS. The study will use a multicentre cluster randomised controlled trial with integral process and economic evaluation. The trial and reporting will follow MRC guidelines for clinical trials and CONSORT guidelines. A strong multidisciplinary study team combines the expertise of established clinical and research teams that have a published record in successfully developing clinical research interventions and completion of large scale randomised trials. The costs of the research represent good value for money. The project will use in-post NHS staff to deliver the intervention. Even a small reduction in HbA1c will have an impact on long term risk reduction with potential costs saving to the NHS.

Planned Investigation
Our intervention, CASCADE, is a competency-driven, motivational and patient-centred structured intensive psycho-educational programme specifically designed by our team to improve diabetic control, self-management and quality of life in children and adolescents. CASCADE is a complex intervention and our proposed investigation is based on the MRC complex intervention evaluation framework.[2] We have already conducted the Phase I study (Modelling - defining components of the intervention and Phase II study (Exploratory Trial Phase). Description of Phase I and findings from Phase II are presented in later sections. We now propose a Phase III large multi-centre cluster randomised controlled trial with integral process and economic evaluation to investigate the effectiveness of CASCADE.
Our extensive experience in teaching and training will be used to identify the time and resources required to train members of the study centres which will be incorporated into the economic modelling process.

Research objectives

i. To assess the feasibility of the proposed structured intensive educational programme provided within a standard clinic setting for a diverse range of young people.
ii. To investigate the effects of the above intervention on long term metabolic control of diabetes.
iii. To evaluate the impact of the intervention on diabetes-specific quality of life using a) well validated and reliable self report and parental measures of quality of life in children and young people and b) specific measures of parental quality of life.
iv. To investigate the impact of the intervention on psychosocial functioning including a) emotional and behavioural adjustment of children and young people and b) family functioning c) self-management, decision making and self-efficacy
v. To investigate the cost effectiveness of the intervention.

Existing Research
Diabetes burden: The increase in numbers of people being diagnosed with diabetes is posing a challenge for both the UK and the rest of the world. The World Health Organisation has named this a "global pandemic", affecting the lives and welfare of hundreds of millions of people with the condition as well as carers and loved ones. There is a significant increase in the number of children and young people diagnosed with Type 1 and other variants of diabetes. The current estimate of prevalence of Type I diabetes in the UK is 1 per 700-1000 children yielding a total population aged under 25 of approximately 15,000 -25,000. The peak age for diagnosis is between 10 and 14 years of age.[3]

The long-term complications of diabetes include microvascular and macrovascular disease, reduced life expectancy (on average by 23 years in people with type 1 diabetes) and higher cardiovascular and all-cause mortality.[4] Complications are often first detected in adolescence. There is clear evidence that improved diabetes control from diagnosis in childhood can reduce the incidence and progression of microvascular complications including retinopathy, nephropathy and neuropathy.[1] There is also evidence that later improved control reduces complications, even after a history of poor control.[1;5;6]
Failure of new insulins and delivery systems to deliver hoped for benefits: However, despite the research evidence of the benefits of intensive insulin regimens and the potential benefits of the introduction of new insulins and methods of insulin delivery (e.g. insulin pumps), the overall metabolic control in children and adolescents has improved little in the UK in the past decade. For example, only 14-20% of children and young people with type 1 diabetes meet the recommended HbA1c of less than 7.5%.[7] The reasons for this are unclear; in adults it has been postulated that the intensive approaches used in trials such as the diabetes control and complications trial (DCCT) are beyond the scope of the staffing levels of most

healthcare systems, and that the increased risk of severe hypoglycaemia related to intensification may be unacceptable in routine clinical practice.[8] Additionally, clinicians formulate treatment goals focusing on biomedical outcomes, whereas patients are more concerned about the immediate demands of treatment and how to integrate these into daily life.[9] In children and adolescents, failure to improve diabetes control is thought to be related to issues related to self- and family management of the implementation of intensive regimens in daily life and adjustment to diabetes, particularly during the developmental changes of adolescence.[10;11] Given the above, there is a concerted search for novel interventions and health delivery mechanisms to help improve control and reduce complications, illness burden and costs to the NHS.[11-13]

Educational programmes for modern intensive insulin regimens: The search for improved control has led to intensification of diabetes regimens (by injections as well as pumps) through carbohydrate counting and the use of insulin to carbohydrate ratios for determining preprandial insulin doses, together with the use of correction insulin doses informed by insulin sensitivity ratios. This has led to the development of adult education skills programmes to train patients in the self-management of intensive regimens without substantial professional support – e.g. DAFNE (dose adjustment for normal eating) which have been shown to be effective[14] and cost-effective[15] in improving HbA1c by approximately 1% point in adults.

Limitations of educational approaches in children & adolescents: Evidence for the efficacy of DAFNE style approaches in children and adolescents is lacking; a modification of DAFNE for children 11-16 years, named KICK-OFF, is currently being developed, taking an educational approach based upon the UK schools curricula.[16] However pilot data has not shown an impact on overall metabolic control.[17] There is considerable evidence that knowledge-based educational approaches increase knowledge without any significant impact on desired behaviour change and therefore such approaches in children and adolescents with diabetes has led to limited improvement in HbA1c.[18] Thus it is unlikely that the success of educational skills training programmes based on knowledge transfer in adults, such as DAFNE, will be successfully generalisable to children and adolescents.

Existing psycho-educational interventions: The importance of integrating medical care and educational and psychosocial interventions has been highlighted in the HTA funded systematic review published by Hampson et al (1999).[18] A recent randomised trial in the US (2003) showed that an intensive psycho-educational programme allied to case-management resulted in 25% fewer total hypoglycaemic events, 60% fewer severe hypoglycaemic events, and 40% fewer hospitalizations and emergency visits than did standard multi-disciplinary care or simple case management approaches.[19] The absence of high quality UK-based studies and the need for a programme of primary research on interventions for children and young people was also emphasised.[18] The review recommends the need to proceed cumulatively and base studies on theoretically guided principles. It is therefore parsimonious that where studies have been shown to be successful these should serve as a starting point for the design of interventions for assessment in the UK. Quantitative and narrative analysis of the evidence-base suggests that interventions are more likely to be effective if they demonstrate the inter-relatedness of the various aspects of diabetes management, assess outcomes that the intervention specifically targets for change and assess outcomes at the appropriate point in times post-intervention to reflect the impact of the intervention.

The review found that the theoretical basis of the majority of trials completed is family therapy. However, there is often very little detail in the papers to be clear which school of family therapy is informing the therapeutic delivery of material. Three groups have used a family/group based approach and obtained robust effect sizes in either metabolic control and/or psychosocial outcomes. Anderson and colleagues reported two RCT studies where the focus was on parent-teen responsibility for sharing diabetes related tasks [20;21] The families met with a research assistant once every 3 months. Compared to a didactic group and standard care group the teamwork group showed a reduction in family conflict but did not produce robust effect on HbA1c. Satin described the largest effect sizes in interventions which used multi-family group intervention (with or without parental simulation of diabetes).[22]. Improvements in HbA1c were reported in the parental simulation group only. However, improved training in delivery skills and smaller group sizes led to significant improvements in HbA1c in both intervention groups. Grey also addressed several aspects of diabetes management and the complex inter-relationships between management activities using a nurse led and peer led group design.[23] The theoretical basis was a positive coping skills model and used coping skills training which found increased competence and mastery in challenges to adolescence. Beneficial effects on both metabolic control and psychosocial outcomes were maintained on follow up. Thus, the evidence supports the clinical view that developmentally appropriate negotiated responsibility has beneficial outcomes. Interestingly all interventions which included parental involvement had beneficial effects on HbA1c and measures of family functioning. However, the review and its constituent studies largely preceded the introduction of modern intensive insulin regimens characterised by carbohydrate counting. Thus, the review is only partially relevant to the new challenge – to identify a psycho-educational programme that will (a) engage and train young people and families in modern insulin regimens using modern educational methodologies; and (b) improve adherence and adjustment to diabetes, thus promoting improved diabetes control.

Background to the proposed intervention

Development of CASCADE

The intervention CASCADE is based upon the findings of the HTA review [18] and our Phase 1 pilot work and includes a number of elements shown to be important in predicting success in improving long –term diabetic control as well as simply transferring knowledge.

Principles of successful psycho-educational programmes in diabetes: Effective components of successful interventions incorporate the integration of medical care and educational and psychosocial interventions; e.g. relating self management

of blood glucose (SMBG) to other aspects of diabetes can demonstrate how information may be used to guide other management behaviours. Multi-component interventions may be more successful than those that focus on one only aspect in improving metabolic control, particularly in adolescents. Additionally, there is evidence that diabetes educators show significant improvements in their skills in educating, supporting and counselling patients when using alternative approaches to traditional didactic methods.[24] Interventions must not only deliver knowledge but ensure it can be put into practice.[25] Caring for children and young people with diabetes is fundamentally different to providing services for adults. It is a complex process that must be firmly focused on the child or young person and their family and/or other carers, supported by the skills and experiences of a wide range of health care professionals. Consideration must be given to the physical and emotional needs of the developing and growing individual along with the social constraints of family, friends, early years and school, as well as adapting to different developmental stages over time. A key component of effective chronic care management involving young people and their families or carers is establishing and maintaining the motivation that will enable them to manage the complex juggling act required to achieve effective management of their condition.[26]

One of the major concerns raised by parents and families is access to quality information and advice in a timely fashion and which is delivered in a consistent and evidence based manner in a form that can be easily comprehended by the user. Conventional expert-centred approaches relying on professional advice are usually unavailable out of hours, which may be one reason for the relatively low uptake of intensive management of type 1 diabetes in the UK. Intensive self-management programmes potentially offer a cost-effective way of meeting family needs also overcoming professional resource limitations.

The UCL Hospitals diabetes team in partnership with families has developed an innovative psycho-educational programme (CASCADE) that promotes engagement, motivation and flexible self management, delivered in a clinic setting with promising improvements in self management, psychological adjustment and long term metabolic control. Previous work by Investigators RV&DC using psychological approaches to promote engagement, motivation and behaviour change, which resulted in a significant reduction in HbA1c,[26] have been incorporated into the psycho-educational programme.

Structure of CASCADE Intervention:
The intervention is delivered in 4 group sessions, delivered monthly over a 4 month period. Children will be grouped by age (either 8 – 11 or12 – 16 years) and participate in groups with 3 – 4 families per group. A developmentally appropriate curriculum supports flexible self management in partnership with the young person, their diabetes regimen and their family. The programme focuses on achievement of increasing competency in self management of diabetes using eight competency levels described by Kaufmann et al.[27] The 'Kaufman competencies' were developed at the Children's Hospital, Los Angeles as an 8 stage competency system surrounding diabetes knowledge and skills (including adaptation of insulin dosage, carbohydrate counting and management of daily challenges (e.g.; exercise, illness, holidays). This system was developed to assess suitability for intensive therapy using continuous subcutaneous insulin infusion (CSII), but is applicable to all current insulin regimens. The competency level of each child can be used to ensure that the psycho-educational programme is delivered in a flexible and developmentally appropriate manner.

Components of CASCADE
CASCADE is consistent with the five key criteria necessary to fulfil the NICE requirements for a structured diabetes education programme.[28] These are i) patient centred philosophy; (ii) structured curriculum; (iii) trained educators; (iv) quality assured; and (v) audited.

(i) Patient centred philosophy
Despite the acceptance of the need for a patient centred empowerment model, health care professionals often fall back into traditional styles of education delivery. The majority of nurses will have been trained using a didactic medical model[29;30] The accepted role of the diabetes clinical nurse specialist (CNS), called a "nurse educator" in many units, is to provide patient focused instruction either individually or in groups.[31] However, knowledge alone is not enough to maintain improved clinical outcome and a frustration for health care professionals is the delivery of information that feels as if it not 'complied with'. This is particularly a challenge in adolescents, with a need to find ways to engage the young person in the process and ownership of the management of 'their' diabetes. Funnel and Anderson (2005) suggest that "diabetes belongs to the patient, and that knowing what is best for a patient's diabetes is not the same as knowing what is best for that person."[32] Anderson et al 1991 observed that diabetes educators could show significant improvement in supporting and counselling patients when trained in self-empowerment strategies, and that a change of the educator's delivery style has greater impact in consultation with patients.[24] Richards et al suggest that patients may be resentful of judgemental professional attitudes and wish to be acknowledged as an expert in the management of their diabetes.[33] There therefore needs to be a shift from giving information to empowering patients to integrate and identify what information is important to them for effective self-care.[34;35]

Motivational and solution-focused approaches: Throughout the Phase I modelling phase CASCADE has been underpinned by an evidence-based patient-centred psychological approach. This includes work by Investigators DC & RV which developed a novel group intervention in which we drew upon elements identified as effective from the HTA systematic review[18]. Our intervention was based on Grey's coping skills training manual[23] and used systemic family therapy theory. We also incorporated previously untested *solution-focused* and *motivational* elements. A non-randomised controlled pilot of the intervention in 20 participants and 21 matched controls produced an effect size of 1.5% (1.0 SD) reduction in HbA1c compared with no change in the control group. This improvement was largely achieved within 1-3 months of the

intervention however benefits persisted 6-12 months later.[26] While this effect size is likely to have been inflated by the non-randomised design, we note that the mean effect size in RCTs identified by the HTA's systematic review in the area was 0.5% (0.33SD).

Motivational Interviewing (MI) is a psychological approach that aims to increase motivation to engage in treatment.[36] MI was developed for conditions where participants are reluctant to enter treatment - e.g. addictions[37] and has been suggested to have potential in diabetes.[38;39] The approach is based on the degree to which behaviour change is important to an individual, their confidence in their ability to achieve behaviour change and the degree to which change is a priority.[40] In a recent pilot study of 22 adolescents with diabetes, individual motivational interviewing was reported to produce a mean improvement of 0.8% (0.53SD) in HbA1c.[41] A second psychological approach with potential efficacy in young people reluctant to engage with standard psychological approaches is solution-focused therapy (SFT). SFT views the patient rather than the professionals as the expert in order to identify "what works" e.g. identifying "what helped" during periods when their diabetes was under control[42] SFT has been suggested as a useful technique in diabetes,[43] and our controlled trial suggested significant potential for improving HbA1c.[26]

(ii) Structured Curriculum
The curriculum content is consistent with the Type 1 education network set up to enable access to training and core content for education programmes. Topics include the nature of diabetes, day to day management, specific issues connected with living with diabetes and sick day rules. The programme consists of 4 monthly modules, 2 -3 hours in length.

(iii) Trained Educators
There is clear evidence that some professions can, in clearly defined circumstances, substitute effectively for others and there is a positive verdict for nurses in terms of the impact of training and transfer of skills, albeit in adult health care. Campbell et al.1998, concluded that nurse led clinics were possible to implement in primary care (in comparison to standard medical follow up) and led to increased secondary prevention in coronary heart disease. Most patients gained at least one effective component of secondary prevention and this could reduce cardiovascular events and mortality by up to one third.[44] In outpatient models diabetes care has been an area of scrutiny and systematic study, utilising a range of models of care.[45;46] A number of RCTs and experimental studies have demonstrated that nurses can deliver effective care with high levels of patient satisfaction. Little work however has been conducted into the transfer of psychological skills to nurses, and the impact of shifting models of care upon the organisation, costs and quality of care or the knock-on effects of the work on other members of the clinical team in terms of the ecology and economy of care. In order to begin to address this the diabetes team at UCLH has developed and published an in-house training programme for nursing staff (and junior doctors) working with young people admitted for management of diabetes.[47] These workshops have been used to identify key features of psychological theory and develop multidisciplinary teaching materials to facilitate communication with young people with diabetes and improve recognition, diagnosis and management of emotional and behavioural difficulties in inpatient and outpatient settings. The training manual for CASCADE will be based on a manual developed by DC for a psycho-educational child and adolescent weight management programme delivered by community workers ensuring quality assured delivery. The training workshops are delivered by independent trainers and are currently undergoing a detailed process evaluation as part of a randomised controlled trial.[48] The training workshops focus initially on the delivery approach (solution focused and motivational enhancement) and subsequently the specific content of each module.

(iv) Quality Assurance
The RCT for CASCADE will include integral evaluation of the training workshops and include review and supervision sessions for the nurse trainers at the end of each 4 month delivery cycle. This will provide feedback and quality assurance in the training process. An evaluation and observation protocol will be developed in order to ensure integrity of the intervention delivery across centres.

(v) Audit
The programme has been developed over the last 7 years. The feasibility of delivering the programme to a diverse population, in a busy clinical service has been demonstrated by us, and has resulted in a consistent reduction in the overall clinic HbA1c, maintained over time. An additional strength of this programme is its potential to support young people who are on less intensive regimens as the motivational component maximises the therapeutic impact of the programme and enables the increase in self management behaviours in a more diverse group of children and young people. The team has incorporated feedback from children, young people and families into the current education programme.

Importance of this research
Burden: The National Paediatric Diabetes Audit (2002) concluded that "UK diabetes care currently does not meet nationally agreed standards and this will continue to cause health problems for children with diabetes now and in the future".[49] Children experience both blood glucose levels that are too low potentially impairing their development and levels that are too high which as already stated increases the risk of developing long-term complications if not addressed. Only one in seven to one in five of children, depending on age group, are currently meeting the recommended HbA1c level (<7.5%). Further action is needed to prioritise and improve standards of care for children and young people with diabetes to meet national frameworks for diabetes and children and provide the standards of care that children and their parents expect"

Expected benefit of the intervention: A successful outcome would provide a clinically effective intervention that could be adopted at low cost throughout the country, without extensive employment of additional professionals. Small

improvements in diabetes control can lead to massive improvements in long term health as well as large savings in health care expenditure. The Diabetes Control and Complications Trial showed that a 1.5% reduction in HbA1c is associated with a 40% or greater reduction in microvascular complications later in life.[1] There is evidence that reducing the current UK paediatric mean HbA1c by 1% would reduce by up to 50% the risk of developing retinopathy and renal impairment over a 10 year period.

Unique contributions of CASCADE: (1) All young people will have received documented education post diagnosis to achieve the basics aspects required for safely managing diabetes (Kaufman level 2).AS a minimum on completion of CASCADE they will learn carbohydrate management (level 3) and correcting blood glucose levels out of the target range (level 4). These latter two competencies, essential for intensive insulin regimens, are an aspiration but are not part of current standard care in most services. (2) CASCADE is unique in that it works at the level of the child's/families knowledge and is adaptable to the child's preferred management of diabetes. Delivery of the specific content of the modules can be modified depending on the particular regimen being followed. (3) Inclusion of motivational enhancement and solution-focused techniques that mobilise existing personal resources and motivate young people to move through stages of behaviour change towards a more intensive regimen. (4) CASCADE focuses on all aspects of living with diabetes, not just management of food and insulin and is available to a wider age range (8 – 16 years) than other programmes

Generalisablity: Given concerns that complex interventions may sometimes not be practical in standard NHS settings, CASCADE is a pragmatic manualised intervention delivered by NHS staff within standard NHS clinics in a representative population-based sample. The process evaluation will ensure that factors influencing the generalisability of this intervention outside of the research setting will be identified.

RESEARCH METHODS

Design

This proposal comprises a multi-centre cluster randomised control trial with integral process and economic evaluation.

Recruitment and randomization of clinics

The clusters to be randomised are clinics in the regional diabetes network and will be recruited by Investigators PH and RV through network structures. The team also has links with SENCE - a Local Medicines for Children Research Network based in London. SENCE is a consortium including Great Ormond Street Hospital NHS Trust, UCL Institute of Child Health, The Evelina Children's Hospital, Guy's and St Thomas' NHS Trust, St Bartholomew's and The London NHS Trust and the Centre for Paediatric Pharmacy Research based at the School of Pharmacy. The network covers health sectors in South East, North Central and East London. Co-applicant IW is the Assistant Director of this Local Research Network. **The power calculations (see Sample size below) require a sample size of 14 clinics per arm with a total of 341 children and young people (approximately 12 per clinic). An average of 40 - 50 families per clinic will be eligible to participate with an expected recruitment rate of 25%. For randomisation, see later details under Allocation.**

Recruitment of young people

As it is important to avoid differential recruitment in the two trial arms (which can leads to bias), clinic staff will be asked to identify eligible young people blind to the randomisation status of the clinic. Families will be asked to take part in a trial comparing different ways of helping young people to manage their diabetes, making clear that all approaches have potential advantages and disadvantages. They will be told that whichever way is shown to be most successful will then be made available to all the families. See also Ethical Arrangements

Planned inclusion/exclusion criteria

Inclusion

Participants 8-16 years with type 1 diabetes and HbA1c $\geq$ 8.5 (defined as mean 12 month HbA1c$\geq$8.5%) cared for in participating paediatric and adolescent diabetes clinics (defined as clinic specific for paediatric and/or adolescent diabetes conducted by a specialist or general paediatrician with an interest in diabetes). An average of 80 - 100 young people per clinic will be eligible to take part in the study with an expected recruitment rate of 25% based on our pilot study.

Exclusion

1. Participants with significant mental health problems unrelated to diabetes that require specific mental health treatment.
2. Participants with significant other chronic illness in addition to diabetes that may confound the results of the intervention.
3. Participants with significant learning disability or lack of command of English sufficient to render them unable to participate effectively in the planned intervention. Note that there is research evidence from this population that the great majority of eligible young people from black or minority ethnic groups in this population have good command of English, although their parents may not.[50] Given the wide range of ethnicities in the sample population,[50] and given the importance of group dynamics to the intervention, it will not be possible to use interpreters to enable parents with poor English to participate. We will ensure that the validity of the study is maintained by the following: (i) young people with good command of English but whose parents have poor command of English will be eligible to attend by themselves if they wish (ii) another relative who is one of the primary diabetes carers (e.g. sibling, aunt or uncle) who has good command of English may participate instead of the parents
4. While inclusive elsewhere, we will not recruit clinics which are unlikely to be able to recruit sufficient participants with a good command of English. We anticipate that this pertains to only one clinic within our sample area.

5. Young people who have participated in diabetes treatment trials in the 12 months prior to collection of baseline data

Established research techniques
We will use the established MRC complex intervention evaluation framework.[2] Outcome evaluation will use validated measures of diabetes control (HbA1c) and validated psychological measures (Details described below)

Policy implications
Currently the NHS must comply with NICE guidance on structured patient education in diabetes, but providers are unable to do so for these age groups due to a lack of evidence-based interventions. Positive outcomes from this trial in terms of reduction in HbA1c and other beneficial outcomes, particularly if shown to be cost-effective, will be highly likely to influence policy in terms of national adoption of CASCADE across the NHS, particularly for those on or initiating intensive insulin regimens.

How participants will be allocated to trial group
This is a cluster randomised trial. Clinics will be randomised to intervention or control groups. Randomisation will be stratified by factors likely to influence clinic mean HbA1c, being clinic age (paediatric or adolescent) and degree of clinic specialisation (district general hospital clinic or teaching hospital/tertiary clinic).

How protected against sources of bias
The randomisation schedule will be drawn up at LSHTM, and the allocation will be concealed until after clinics have consented, thus guarding against selection biases at entry of clusters to the trial. To reduce the risks of bias in the recruitment of families within clusters, where possible the local clinician identifying participants will be blind to allocation until after the patient is assessed as being eligible or not.[51] The risk of assessment bias will be reduced by having the primary outcome measure (HbA1c) analysed by a central laboratory without knowledge of treatment group.

Pilot study research findings and implications for the proposed research
Results of Phase II Exploratory study: The education programme modules of CASCADE have been delivered to all children/families in the UCLH Child & Adolescent Diabetes Service during clinic visits and during the annual review. HbA1c is collected every three months as well as downloading blood glucose meter data. Prior to initiating structured education in 1999 the mean clinic HbA1c for the combined paediatric and adolescent populations was 11.1% (< 12 years mean 9.8%, >=13yrs 11.4%. In 2006 the total clinic mean was 8.7% (<12 yrs 8.3%, >=13 yrs 9.3%). Translating HbA1c into the relative risk of developing complications using the DCCT complications data set[1] shows that there has been a reduction from 41% in the >6 risk grouping in 2004 to 28.4% in 2005. CASCADE has been piloted with 33 children and young people started on insulin pumps. Compared to children previously started on pumps without the education programme there was a greater reduction in HbA1c and mean blood glucose levels, decrease in episodes of severe hypoglycaemia and improved family functioning. In addition children and young people completing the education programme showed better long term improvement

Planned Intervention
The intervention is delivered in 4 group sessions (modules), delivered monthly over a 4 month period. Each module will include the following educational and motivational structure:
i. Identify learning objectives: Trainers invite families to identify recent aspects of diabetic management that have gone well to encourage them to see themselves as experts in their diabetes and to help them identify strengths, resources and abilities. Participants are encouraged to identify what they would find useful or helpful to discuss and think about during the session. This ensures that participants collaborate in the identification of learning objectives
ii. Addressing ambivalence: Desired behaviour change choices are discussed using motivational enhancement techniques that address ambivalence. Participants identify the pros and cons of behaviour change acknowledging that any change in behaviour will have both costs and benefits. Motivational interviewing focuses on encouraging the individual to identify the personal and systemic benefits of the desired behaviour to them and their family.
iii. Externalising: Externalising language encourages participants to characterise the diabetes as something that is 'external' to the individual and therefore 'controllable'. This creates opportunities for young people and families to work with the health care professionals by identifying ways to take control of diabetes rather than it being something that controls them.
Pre and post session knowledge will be evaluated as well as inviting feedback on how useful and helpful the session has been and what actions the young person plans to initiate in between sessions.

CASCADE module content

Module 1: Living with diabetes – challenges and choices • identification of strengths, resources and abilities • assessing stages of change and enhancing motivation to change • Making choices in day to day circumstances • The reciprocal relationship between diabetes and being a young person o Growth o Puberty o Insulin resistance o Healing	**Module 3: Adjusting Insulin doses – the pros and cons** • How insulin works • Review of injection techniques and injection site rotation • Insulin stacking • When and when not to adjust • Relationship between insulin action and exercise • Relationship between insulin action and illness • What are ketones, when should you test and what do they mean • DKA and when to seek help
Module 2: Blood sugar testing – the pros and cons • Identifying appropriate target ranges • Identifying what makes blood sugar go up/down • Learn how BM can improve management • Identify when to monitor and how to identify trends • Thinking about emotional responses to BM • Giving of insulin sensitivity ratio • When to correct and what to aim for • When to recheck • What to do if BG level has not fallen	**Module 4: HELP with Food, activity and exercise – a Healthy Eating Lifestyle Plan** • Why eat • What to eat • Eating out • The Pros and Cons of counting carbohydrates • Lifestyle activity • Programme activity • Ketones, blood sugars and exercise • Free carbs and exercise • Travelling, holidays and diabetes • School and diabetes

Families in the intervention clinics who do not participate in the groups will continue to receive standard care

Control arm

Control families will continue to receive standard care[49] from their clinical team, being regular 3-monthly clinic visits and telephone contact as required with the clinical nurse specialist and consultant. The process evaluation will monitor and describe standard care as well as the new intervention being tested

Outcome measures

Primary outcome: Change in HbA1c between baseline and 12 and 24 months **after the date of baseline blood sample**.
NB. It is not possible to directly evaluate the effects of the intervention on diabetes complications because of low incidence during adolescence.

Secondary outcomes:

a. Economic evaluation: This will include within-trial cost-effectiveness analysis; and a cost-utility analysis based on a model combining data from the trial with data from the literature. The perspective adopted will be that of the NHS, that is, the economic evaluation will only consider costs to the NHS and health benefits to patients.

b. Psychosocial outcomes (using validated instruments appropriate for age)

1. Health related quality of life (QOL): PedsQL with Diabetes module[52]
2. Self-Efficacy in Diabetes scale[53]
3. Diabetes Family Responsibility Questionnaire[54]
4. Strengths and Difficulties Questionnaire (parent and child report versions)[55]

c. Diabetes outcomes directly related to patient management:

1. Kaufman Competency level[27]
2. Diabetes regimen (insulin delivery/number of injections/insulin types)
3. Hypoglycaemic episodes (frequency, severity)
4. Admissions to Hospital and reason (e.g. episodes of ketoacidosis, hypoglycaemia)

d. Diabetes outcomes indirectly related to patient management:

Knowledge and skills associated with diabetes

e. *Compliance with intervention/control:*

1. Attendance at intervention sessions
2. Service utilisation rate
3. Clinic attendance
4. Number of contacts with diabetes nurse specialists and diabetes teams

Process evaluation

Aims The study will incorporate an integral process evaluation, similar to other trials conducted by SSRU.[56-58] The overall aims of this will be to: monitor the implementation (including extent of uptake) of the intervention in experimental clinics and any alternative intervention received by young people and families attending control clinics; document factors influencing the implementation of the intervention; identify components of the intervention which contribute to its effectiveness; assess the acceptability of the interventions to young people, parents and clinic staff; examine perceived impact of the intervention on outcomes. Specific issues that will be addressed include: the quality of training for clinic staff and satisfaction with this; the extent to which the sessions with young people and families are delivered as intended and according to underlying principles and theories (e.g. patient centred and non didactic, motivational and solution focused), barriers and facilitating factors to the uptake and engagement with the different components of the sessions by young people and families (e.g. structural such as timing of sessions, accessibility of clinics, and interpersonal such as views about relevance of content, qualities of educators), and perceived impact of the sessions on management of the condition by young people and their parents. This might include examining how decisions are made and responsibilities for different aspects of the condition-management are shared, including transfer of responsibilities and changing patterns of self-care by the young person in different contexts (e.g. during school time, at home). Issues such as whether interventions should be targeted for different age groups, for the different disease stages, or for young people with different types of diabetes management problems will also be explored.

Data collection

A. HbA1c. This will be collected in two ways because of problems with standardisation.

1. Venepuncture at baseline and 12 and 24 months **after the date of the baseline blood sample**: For the primary outcomes, HbA1c will be collected by venepuncture (by a skilled operator in a child-friendly setting, with local anaesthetic offered) and transported to a single laboratory (University College Hospital) for analysis. This will ensure direct comparability of results from all clinics.
2. routine clinical measurement of HbA1c (secondary outcomes). It is standard practice to measure HbA1c 3 monthly and the researchers will assist the clinic staff in ensuring that these data are obtained and recorded for all participants at 3 and 6 months post recruitment. Values from the different clinics will be standardised to DCCT aligned values using an accepted approach.

B. Questionnaires: A range of diabetic, economic, psychosocial and quality of life data will be collected at baseline and 12 and 24 months **after the date of the baseline blood sample** using standardised questionnaires. Participants, parents and clinic staff as appropriate will complete questionnaires in clinic or, where recruitment is carried by a local clinician, over the telephone (with researchers).

C. Economic data: In addition to HbA1c and questionnaire data on service use, data on costs of the intervention will be carefully recorded by researchers and clinic staff.

D. Process evaluation data: A key aim of the process evaluation is to bring together the views and perspectives of the different research participants (e.g. young people, parents and clinic staff). Qualitative and quantitative data will be collected through i) observation of training of clinic staff and delivery of intervention sessions with young people and parents ii) focus groups with young people and parents iii) interviews with trainers, clinic staff delivering sessions to young people and other stakeholders iv) structured questionnaires with young people and clinic staff. Trained researchers who have extensive experience of working with young people and other staff and who have no involvement in the design or delivery of the intervention will carry out all data collection.

i) *Observation of training of clinic staff and **education** sessions with young people and families.*

Researchers will carry out non participant observation of **a number of** training sessions with clinic staff from the **14** experimental clinics. Brief notes will be taken during the sessions and these written up with details immediately afterwards. These transcripts will record the training content, activities used and salient aspects of the trainers' and participants' interaction. **Researchers will also carry out non participant observation of each of one complete group of the 4 CASCADE modules, delivered by the trained clinic staff, in each experimental clinic. Notes will be taken during the session by the researcher and a proforma completed as soon as possible after the session. The proforma will include details on: who delivered the session; attendance by young people and parents; venue; timing; completion of objectives and any other significant issues. Feedback from conversation with staff delivering the session will also be noted.**

ii) ***Interviews with young people and parents*. Researchers will carry out interviews with up to 4 young people and 4 parents in each of the 14 experimental clinics and up to 2 young people and 2 parents in each of the control clinics. Interviews allow the views and experiences of participants to be identified in the context of their own setting; they also minimise inconvenience for all stakeholders, compared with focus groups, in that they can be conducted in the clinic setting at the same time as follow-up data is collected or, alternatively, over the telephone if that should not be possible. A sampling strategy will be used, for the young people's interviews, to ensure diversity of perspectives with respect to age, gender and engagement with services including the CASCADE intervention. Those identified as potential interviewees will be invited to take part in an interview by a member of the research team. The interviews will be audio taped and transcribed verbatim. Coding frames will be devised based on the issues raised. Young people completing an interview will be provided with a £10 high street voucher as compensation for their time.**

iii) *Interviews with trainers, clinic staff and other stakeholders.* Researchers will interview all members of the training team and will interview a purposively selected sample of clinic staff involved in delivering sessions at the experimental

clinics (e.g. the lead trainer) and who have contact with young people in the control clinics **(usually the lead DSN),** as well as other key stakeholders working within the **clinics (e.g. medical consultants, dieticians).** These staff will be chosen to ensure a diversity of perspectives based on researchers' observation of staff training and education sessions with young people. Semi structured interviews guides will be used and all interviews will be audio-taped and transcribed.
iv) *Structured questionnaires with young people and clinic staff.* Questions pertaining to the process evaluation will be included in the baseline, and two follow up questionnaires (12 and 24 months). These will be completed at routine clinic visits, or where recruitment is carried out by local clinicians, over the telephone (with researchers). Questionnaires will be self completed but researchers will be available to support young people. Clinic staff (at experimental and control clinics) will also be asked to complete a short questionnaire prior to delivering the sessions and after each block of 4 sessions. These will collect basic background demographic information (including previous experience of training)) and information related to the implementation of the sessions. Clinic staff will also be asked to complete a short proforma after each session to record information about attendance and issues covered.

Compliance issues
i) Intervention compliance: Attendance at the UCLH annual reviews and education days are extremely high and a recent audit of parental attitudes towards psychological support found that 80% of those questioned would be interested in attending individual or group interventions. Analysis of reasons for not attending included timing of groups with respect to school and transport cost issues. Where possible the groups will be delivered with minimum disruption to school attendance. Age banding will also improve attendance.

ii) Research compliance: **For both intervention and control participants, compliance with the primary outcomes (HbA1c) is likely to be high as this is a routine clinical test. As compliance with secondary outcomes (e.g. completion of psychological measures) may be lower, we have inflated our power calculation to account for this (see below). Participants will be provided with a £10 high street voucher as compensation for their time to provide outcome data at 12 and 24 months. Such an approach has been shown to reduce attrition. The psychological instruments being used are standardised and are well validated. The measures selected have been reviewed by CS for acceptability and have been used by us (RV, DC) in research and clinical samples over the last 9 years.**

Rate of loss to follow up
We anticipate a drop out rate of approximately 10% and have inflated our sample accordingly (see Sample size below). We have been conservative in our estimates of recruitment (25% of eligible), in line with our previous experience. Note also that the motivational elements of this intervention are specifically designed to enhance retention; e.g. drop out during our previous motivational/solution-focused intervention[26] was minimal (approx. 5%) over a similar number of sessions. For standard care, we estimate that loss to follow-up in our clinic is <10% per year. We will use regional and national diabetes networks and Diabetes UK contacts to follow-up those lost to follow-up due to moving.

Ethical arrangements
The trial will be performed in accordance with the recommendations guiding physicians in biomedical research involving human participants adopted by the 18th World Medical Assembly, Helsinki, Finland, 1964, amended at the 52nd World Medical Association General Assembly, Edinburgh, Scotland, October 2000. The study will be submitted for approval by the UCL/UCLH Research Ethics Committee (REC) prior to entering clinics/participants into the study. Consent to clinic randomization will be obtained from the responsible clinician. Informed written consent and/ or assent will be obtained for participation in intervention and/or research procedures from the children and one parent, as per standard procedures for cluster randomized trials.[59] The right of a child or parent to refuse participation without giving reasons will be respected. The child/young person or their parent will remain free to withdraw at any time from the study without giving reasons and without prejudicing further treatment. If a participant withdraws consent from further trial participation their data will remain on file and will be included in the final study analysis. If a participant withdraws consent for their data to be used, the data will be destroyed immediately. For adverse reactions, see DMEC below.

Confidentiality
All information collected during the course of the trial will be kept strictly confidential. Information will be held securely on paper and electronically in the SSRU (process evaluation) and LSHTM (outcome evaluation). The study will comply with all aspects of the 1998 Data Protection Act and operationally this will include:

1. Consent from children and parents to record personal details including name, date of birth, address and telephone number, GP name and address and NHS number
2. Appropriate storage, restricted access and disposal arrangements for personal and clinical details
3. Consent from children for the data collected for the trial to be used to develop new research. The child's name, address and telephone number will be collected when they are randomised into the trial but all other data collection forms that are transferred to or from the CTRU will be coded with a trial number and will include two identifiers, usually their initials and date of birth.
4. Consent from patients for access to their medical records by responsible individuals from the research staff, where it is relevant to trial participation

Risks and anticipated benefits for trial participants and society, including how benefits justify risks
Potential risks to participants: Education is an essential part of delivering diabetes care and there are no potential adverse effects anticipated as a consequence of the education content. Any changes to insulin dosage (or moving to intensive

insulin regimes) will be in association with supportive written information, delivered by the Clinical Nurse Specialist known to the child or young person. This individual will already be responsible for providing day-to-day support, and normal clinical care will emphasise when it is appropriate to seek advice from the clinical team (e.g. when blood glucose levels are consistently outside of target range).Children and parents will complete a number of psychological questionnaires that have been used in previous studies and are used regularly as part of standard clinical practice. Care will be taken during focus groups and interviews to ask questions in ways that will not provoke distress. Trained researchers who have extensive experience of working with young people will carry out data collection (questionnaires, focus groups, observation and interviews). In a small number of cases, clinical staff may support young people to complete baseline questionnaires (e.g. if researchers are not able to attend a clinic session or are supporting someone else at the same time). Any staff involved in supporting young people will be fully trained by researcher officers. Research participants will be given information about sources of help and support after taking part in research activities and will be able to access consultation advice and support from the PI, a consultant clinical psychologist. The PI will liaise with each study centre to ensure there is appropriate access to consultation, advice and psychological support should any participant express any concerns or worries. Where appropriate, families will be encouraged to seek appropriate professional help and will be provided with referral details. In exceptional circumstances, for example disclosures of significant risk (to self or others), feedback to the family' professional carer will be provided. Participants will also be reminded that Diabetes UK provides an independent voice of support, through their careline.
Potential benefit for research participants: Control of diabetes frequently worsens through adolescence. The microvascular complications of diabetes can become evident in mid-adolescence, particularly in those with diabetes for more than 5 years. Reduction in HbA1c is strongly predictive of reduced risk of these later microvascular complications. In the short term, success in improving HbA1c may also improve general well-being and function and improve psychological function. Participation in the intervention will contribute towards support for difficulties identified by the young person and their parents. Additionally, young people who participate may feel empowered by identifying what they have found helpful in managing diabetes and the various inter-related aspects in their life, and from realising that they are not the only ones to have had problems.

Proposed time period for retention of relevant trial documentation
The data will be preserved for inclusion in traditional or individual patient data meta-analyses and will therefore be retained for a minimum of 15 years or ideally until the determined intervention becomes obsolete.

Informing potential trial participants of possible benefits and known risks/ Obtaining informed consent from participants whenever possible
Clear written information will be provided about the nature of the project. As part of standard care, young people and families will be aware of the importance of maintaining HbA1c's within target limits. The information sheet will outline the potential benefits and risks of participation on the project. Children and young people under the age of 16 will be invited to give assent to participation as well as inviting informed consent from parents/carers.

SAMPLE SIZE
Number of patients, centres recruitment rates
The standard deviation (SD) of Hb1Ac in the target population is approximately 1.5%. We propose to recruit sufficient young people to allow the trial to detect a difference between groups of 0.5 standard deviations, i.e. 0.75%, with 90% power at a significance level of 0.05 (2-tailed); this is considered to represent a moderate size of effect. This is a highly clinically meaningful effect, given that the Diabetes Control and Complications Trial showed conclusively that a reduction of approximately 1.5% in HbA1c reduced the risk of microvascular complications in adults by 40% (microalbuminuria) to 75% (retinopathy) over 6.5 years,[1] with similar benefits seen in adolescents.[60] There is considerable other evidence that smaller reductions in HbA1c, of the order of 0.5% are clinically highly significant, e.g. the DCCT found a continuous association of higher HbA1c and greater microvascular risk.[1] The DAFNE trial in adults had an effect size of approximately 1% reduction in HbA1c.[14] Additionally, a reduction of 0.5SD is half the effect size identified in our pilot work (1.0 SD). Our power calculations are based upon an intracluster correlation coefficient (ICC: the variability in outcome between clinics divided by the sum of the within-cluster and between-cluster variabilities) of 0.1. In the absence of reliable data on which to calculate an ICC for the clinic population, this has been chosen to be compatible with databases of ICCs such as http://www.abdn.ac.uk/hsru/epp/cluster.shtml.

With these assumptions, 14 clinics in each arm with an average of 11 young people in each would be required to detect a difference of half a standard deviation (0.75) with 87% statistical power at 5% significance. Given the possible loss to follow up of approximately 10%, the target recruitment will be inflated to 12 young people from each clinic. This is in line with the expected 25% anticipated recruitment rate as experienced in our previous intervention study.

Proposed type and frequency of analysis
All primary analyses will be carried out according to the principle of intention-to-treat and taking into account the clustering. Every effort will be made to obtain outcome measures on participants, even if some drop out during the course of the group sessions. The data will be analysed by multiple regression modelling, fitting baseline measures of outcomes as covariates. The small groups in which experimental and control interventions are delivered will be fitted as a random effect. A small number of secondary analyses based on explicit hypotheses, e.g. subgroup/ explanatory analyses

(considering compliance with the interventions), will be specified in advance. Interim analyses will be reported in confidence to the independent DMEC (see below).
Qualitative data analysis will use observations, interview and focus group transcripts as well as open-ended questionnaire responses. Our qualitative analysis would aim to develop key emerging themes and then test the validity of these in the light of other qualitative data. Our approach to analysis would employ a system of coding and memoing developed by Lofland and Lofland (1995),[61] facilitated by the use of NVivo software. First, the key topics and issues that emerged from the data would be identified through familiarisation with transcripts or documents. Pertinent excerpts that illustrate emerging themes would be coded and memos would be written to summarise and synthesise these emerging themes. In an iterative process, researchers would refine their analysis, ensuring that the themes built up were cross-checked with other data firstly within transcripts and then between transcripts so that the validity of emerging explanations would be tested and improved. In this way, the data would be ordered within an analytical framework based on the data. To maximise the validity of our findings, two researchers would separately analyse a sample of the qualitative data and then meet to compare their analyses and agree a framework for full analysis of all data. Quantitative data (from structured questionnaires) would be analysed using SPSS or STATA. Demographic data would allow the characteristics of trainers and clinic staff to be described. Key process measures would provide insights in to the generalisability of themes arising from interviews and focus groups. These data, in combination with structured outcome measures will provide insight into, and possible explanations for, any differential success of the intervention, ensuring that the barriers and facilitators that are important in determinants in the success of the intervention are identified. They will also provide evidence from which conclusions regarding the generalisability of the intervention to other contexts can be drawn.
Economic evaluation: The economic evaluation will assess the potential cost-effectiveness of a structured education programme to improve diabetic control in children and adolescents. The comparator will be standard education during clinic appointments. A successful intervention will result in better glycaemic control, which could improve life expectancy and improve health-related quality of life (partly as a result of a reduction in complications). The impact on resource use will have two main elements: the cost of delivering the intervention (including the costs of training of relevant staff); and future changes in resource use as a consequence of a successful intervention.

The within-trial analysis will be in the form of a cost-effectiveness analysis estimating the incremental cost per unit change in glycosylated haemoglobin levels achieved 24 months post recruitment. However, such a measure of cost-effectiveness is of limited value in informing decision making because it is not clear how much the NHS should be willing-to-pay in order to achieve improvements in metabolic control, it only permits comparison with a very narrow range of other interventions, and it ignores longer term health benefits and health care cost savings as a result of a successful intervention. Therefore, the cost-effectiveness of the intervention will also be estimated over a longer time horizon and in terms of cost per quality-adjusted life-year gained. This will be achieved by combining information from the trial (the impact on HbA1c and the incremental cost of the structured intensive intervention) with estimates of other parameters from the literature. This will involve constructing a model of future health care resource use and health outcome (in terms of survival and health–related quality of life) based on the changes in HbA1c observed over follow-up. Successful modelling beyond the two year follow-up of the trial will depend particularly on the specification of the relationship between changes in HbA1c and the risk of complications, and on the evidence in the literature on the health utilities associated with different diabetes-related health states. Deterministic and probabilistic sensitivity analyses will be undertaken to reflect the considerable uncertainty regarding these and other aspects of the model.

RESEARCH GOVERNANCE

Clinical governance

To ensure responsibility and accountability for the overall quality of healthcare received by children during the study period, clinical governance issues pertaining to all aspect of routine management will be brought to the attention of the project group. A Trial Steering Committee (TSC) (Independent chair plus 2 independent members plus PI) will be appointed. Observers from the HTA will be invited to TSC meetings.

Data monitoring & DMEC

Data Monitoring and Ethics Committee: An independent Data Monitoring and Ethics Committee (DMEC) will be established to review, in strict confidence, data from the trial approximately half way through the recruitment period. The Chair of the DMEC may also request additional meeting/analyses. In the light of these data and other evidence from relevant studies, the DMEC will inform the TSC if in their view:

1. There is proof that the data indicate that any part of the protocol under investigation is either clearly indicated or clearly contra-indicated either for all patients or a particular subgroup of patients using the Peto and Haybittle rule[62;63]
2. It is evident that no clear outcome will be obtained with the current trial design.
3. That they have a major ethical or safety concern

The DMEC will monitor data for quality and completeness. Missing data will be chased until it is received, confirmed as not available, or the trial is at analysis. Data quality, follow up and trial monitoring will be facilitated through the development of a trial specific database, including validation, verification, monitoring and compliance reports and follow up report functionalities. A monitoring schedule covering the roles and responsibilities of the Researcher, Project Team,

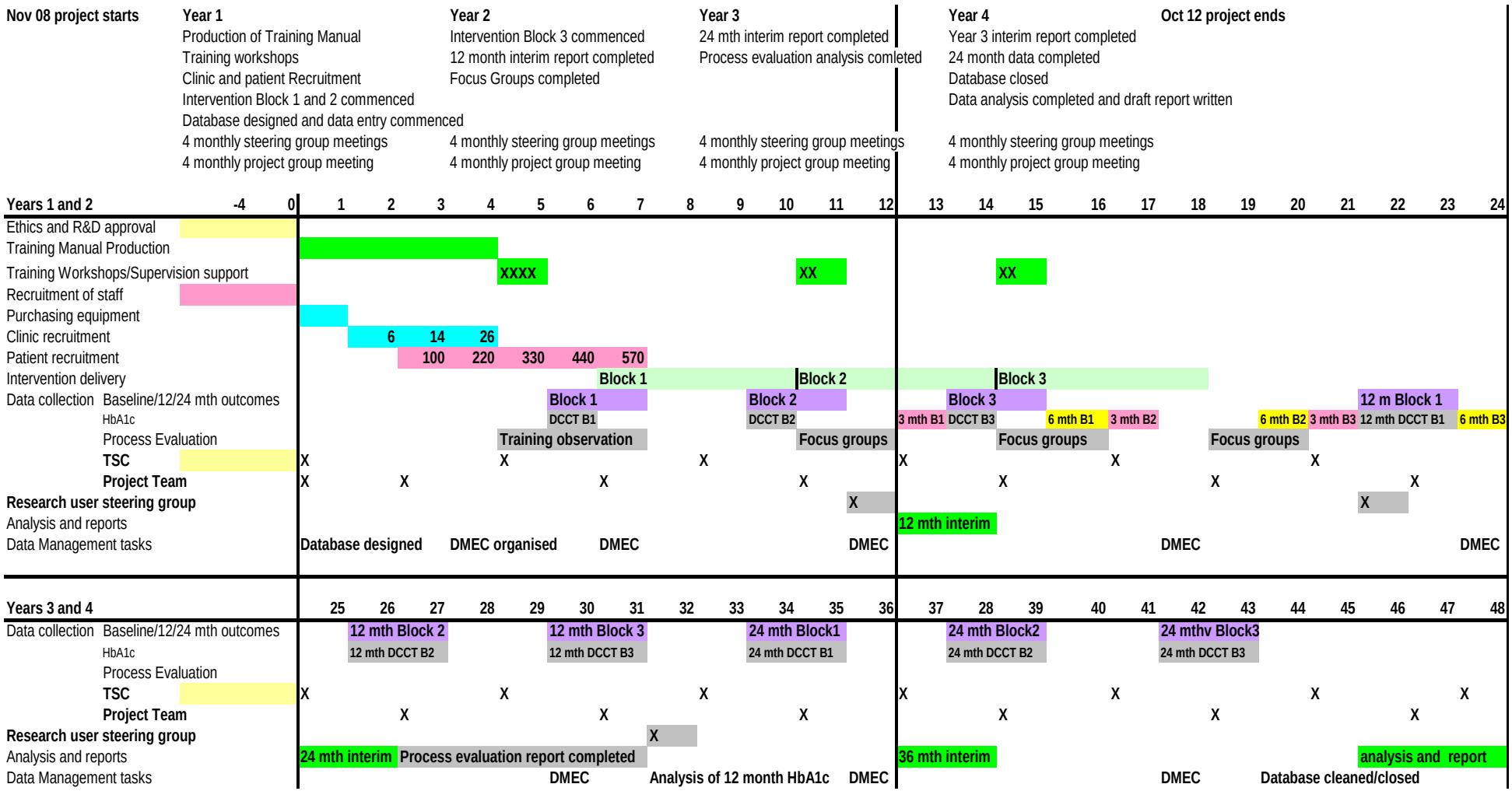
Management Committee DMEC and TSC for monitoring recruitment, data quality, compliance, safety and ethics will be developed and agreed.

Adverse Events:
Adverse events will be monitored by the DMEC. Reported adverse events will be recorded if they occur at any time from randomisation until trial completion. This will include adverse events reported to the PI, senior research officer or other members of the research team by the child or parent at clinic or the follow-up assessment. Information collected will include full details of the event, its duration, action taken and outcome. Any serious unsuspected adverse incidents will be reported to the Sponsor and appropriate authorities.

Sponsor
The trial sponsor will be UCL Hospitals NHS Foundation Trust.

Quality Assurance
The trial will be conducted to the principles of MRC Good Clinical Practice (GCP) Guidelines and CTRU Phase III Trial Standard Operating Procedures.

Project timetable and milestones



Expertise

The study combines expertise from four multidisciplinary institutions with strong cross professional links.
A. Development and implementation of the structured psycho-educational intervention will be carried out by the UCLH diabetes team (DC, RV, PH, RT). The team have received diabetes and obesity best practice awards. The PI, **DC,** has provided psychological development of the training programme with a track record in (i) development of interventions in diabetes and obesity in children and adolescents.[26;48;64;65] (ii) client evaluation and peer based participation in clinical programmes. She is a national and international presenter and trainer in adapted Motivational Interviewing and Solution Focused approaches. She has experience in both quantitative research (joint grant holder in two large case-control trials) and qualitative research. DC received an award for outstanding contribution to clinical health psychology in 2004. **RV** is a diabetologist and epidemiologist who leads the innovative clinical services for adolescents (with diabetes and other conditions) at UCLH. He has recently successfully led and managed a large collaborative project involving 3 universities funded by the Department of Health, integrating both qualitative and quantitative research with adolescents. **RT** is chair of the RCN Paediatric and Adolescent Special Interest Group responsible for the development of policy and co-ordinating local professional activity. She is a member of the DH Child and Adolescent Diabetes services working group, and a regular contributor to national nurse education programmes. **PH** is Professor of Paediatric Endocrinology at UCL. Current research interests are the analysis of complex systems using chaos theory and the applicability of such analysis to understand the complex interactions that surround insulin therapy and diabetes care delivery. He chairs the DH UK Working Group on commissioning Children and Young People's Diabetes Services. PH is the co-ordinator of North London Diabetes network and will work with RV to supervise the clinical medical elements of the work and liaison with participating diabetes services. **FA**: FA who is a regular contributor to national guideline development groups and professional workshops will provide clinical expertise in nutritional management of exercise and diabetes. She has extensive experience in providing education to children, young people and their families.

B. Coordination of the trial including recruitment of trials participants, ensuring procedures for obtaining informed consent from participants, data collection and analysis of process data will be carried out by a team of independent researchers from the Social Science Research Unit at the Institute of Education (SO,VS,KS) and UCL School of Pharmacy (IW,FS). The SSRU is at the forefront of developing approaches to integrating process evaluations in trial design and involving users. **VS** has extensive experience of coordinating (cluster) trials of social and education intervention[56;58;66]; **SO** has a special interest in public involvement in planning and conducting research built on ten years' experience as an advocate of service users and their families, followed by twelve years' experience as a social scientist developing systems to support public involvement in guiding health technology assessment. She brings skills in facilitating communication between lay people and researchers around the design and conduct of research. **IW** is the only pharmacist to have been awarded a DH Public Health Career Scientist Award. He has also received the Neonatal and Paediatric Pharmacists Group Award (2003) and Chemists and Druggists Pharmacy Practice Research Medal (2004) for his research in paediatric medicines. He currently holds more than £2 million in research grants from the MRC, DH, EC and the pharmaceutical industry. **FS** has managed large collaborative multi-centre studies into partnerships between informal carers and care-recipients regarding the use and management of medication for chronic conditions including diabetes in the context of home, school and professional care settings.

C. A team from the Medical Statistics Unit at the London School of Hygiene and Tropical Medicine (LSHTM), led by **DE** will provide expertise regarding trial design and undertake the randomisation and all statistical analysis (EA). DE's expertise is in RCTs, systematic reviews, the views of consumers (especially qualitative studies of the views of participants in trials), reporting of trials, data monitoring committees, and cluster RCTs. She applies these interests in various fields, currently including intensive care of newborn babies, children and adults, and care of the elderly
The Medical Statistics Unit has a proven record of accomplishment at supporting trials funded by the HTA. DE is a key contributor to the development of the CONSORT guidelines for cluster trials.[67] All data entry and data management (of outcome data) will also be carried out by the team from the Medical Statistics Unit under the supervision of **EA** who is a research statistician providing expertise in medical statistics and an experienced educator. Her main research expertise is in inter-rater agreement and reliability, the analysis of multinomial panel data and the analysis of complex interventions. She is currently working on a RCT of tight glycaemic control of children in intensive care and of the effect of n-3 LCPs on cognitive performance in older people in the UK.

D. **JC** (a member of the LSHTM health economics unit) will supervise all economic aspects of this research. He has extensive experience of the conduct of economic evaluations of health care interventions. His membership of a NICE Appraisals Committee and the Scottish Medicines Consortium give him a clear understanding of the data required in order to inform decision making with respect to scarce health care resources.

Service Users

Aim of the active involvement

Ensuring that service users and potential users of research are involved in the design and governance of the proposed trial is a key objective of this study. Members of the research team at SSRU have considerable experience of designing randomised controlled trials in such a way as to maximise the involvement of research participants and ensure the active involvement of those most at risk of marginalisation.[68;69;70] To facilitate the involvement of users, the research team will convene a steering group of research and service users. This will include representatives from key policy makers and clinicians. This will meet three times during the study and will provide an opportunity for the research team to consult

about the research design and methods for data collection, choice of outcomes and methods for data analyses. The steering committee will have an important role in interpreting initial findings and developing dissemination strategies.

Description of service users to be involved

The research proposal has been developed with input from Simon O'Neill, Director of Care and Policy at Diabetes UK and Cassie Solomon a young woman with diabetes, currently transitioning from adolescent service to young adult clinic with experience of a range of educational and psychological interventions since diagnosis; **SO'N** is Director of Care and Policy for Diabetes UK, the peak UK diabetes charity, and is responsible for promoting quality diabetes care and education. He is joint Chair of the DH/NDST/Diabetes UK structured patient education working group which produced the NICE approved standard for education and the self assessment toolkits for diabetes education programmes.[28] He is closely involved in the NDST/Diabetes UK work programmes developing guidance on children's care and care planning. He has had Type 1 diabetes for 15 years and has experience of structured education directly through the DAFNE programme. **CS** is in the second year of University studying Law. She has had diabetes >10 years and has had experience of working with the multidisciplinary UCLH team and has provided feedback about the different psycho-educational approaches that she and her family have been offered since she was first referred to the service.

Description of the methods of involvement

Consultation with young people and parents will be carried out in intervention and comparison clinics using focus groups. The views gathered in these discussion groups will inform the development of research procedures (for example, ensuring young people can provide informed consent for participation in the research, and that appropriate outcome measures are examined), the tools for data collection and the process evaluation. Focus groups will also provide an opportunity for young people to contribute to the interpretation of the study findings. Further consultation with young people will also involve the piloting of all research tools to ensure their acceptability to participants and their appropriateness for clinic use.

Guidelines for compensation followed

Current guidelines (see INVOLVE www.ncchta.org/advert.htm) will be followed to offer appropriate compensation for user representatives to cover travel and contributions to attendance at project group meetings. Focus group participants will receive compensation for expenses incurred attending additional visits required to participate in the group sessions.

Justification of support

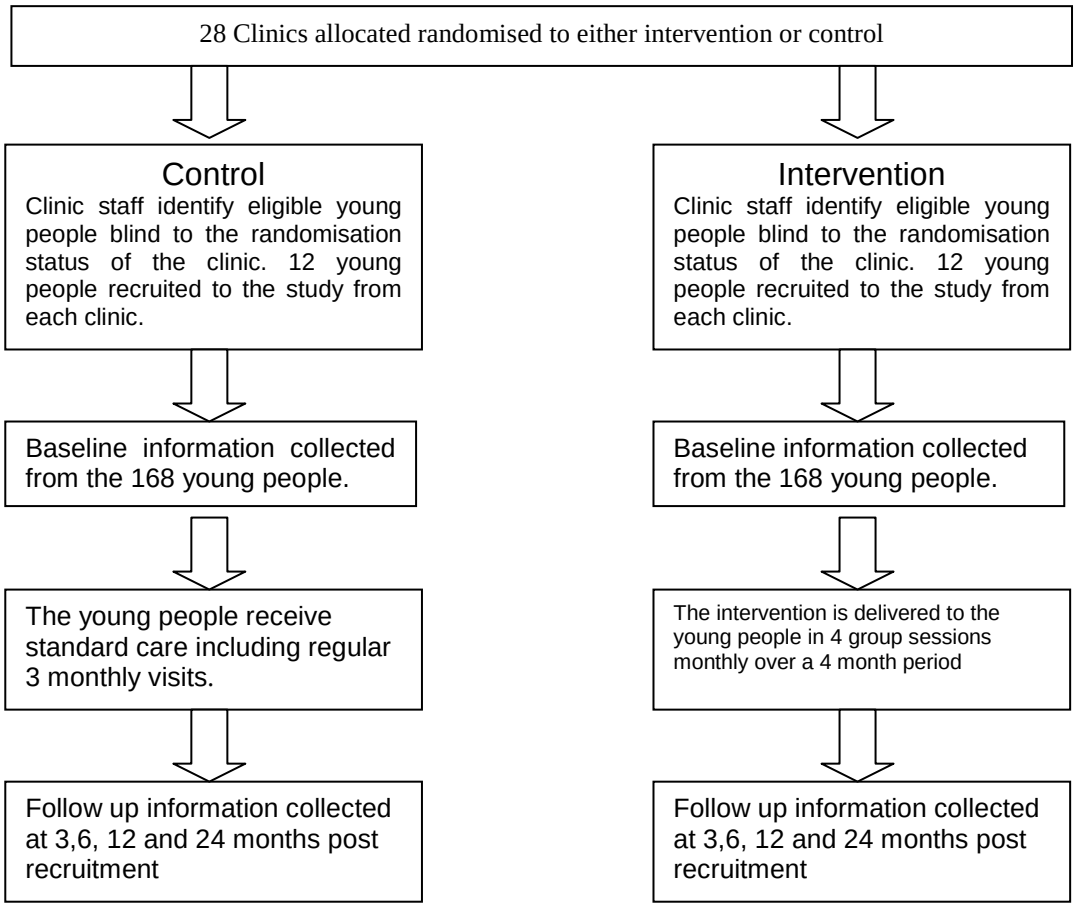
Staff Numbers and grades, timescales

The principal investigator will be responsible for overall project implementation and management with support from the senior research officer. DC will convene the project group and TSC meetings and be responsible for supervising drafts of research results for publication in peer reviewed journals as well as presentation of data at relevant national and international meetings. In addition DC will be jointly responsible (with BT) for the production of the training manual, delivery of the training workshops and clinical supervision of the trainers during the delivery period. DC will require 40% fte funding over the 48 months. BT will require 50% fte funding (18 months) for production of the training manual and workshop materials. A senior research officer (50% fte) based at the Social Science Research Unit will coordinate the day to day running of the trial. This will include working with the statistician and data manager to carry out clinic recruitment and randomisation, supervising data collection including process evaluation, baseline and follow up questionnaires (encompassing all secondary outcome measures), supervising researchers carrying out fieldwork and data management and analysis of data from the process evaluation, working with the data manager and statistician to carry out outcome analysis, contributing to writing of reports and papers. Two full time research officers will work with clinic staff to recruit research participants, carry out data collection and analysis of process data and contribute to the writing of reports. One will be based at SSRU and one at the School of Pharmacy UCL. The Medical Statistics Team will be led by Professor Diana Elbourne (2% fte) and will include a senior statistician, Elizabeth Allen (25% fte) who will carry out all data analysis and a data management team who will carry out all data entry and management of primary outcome data and baseline and follow up questionnaire data (from young people). The economic modelling will be carried out by a full time (100%) economics research fellow (RA 1A) over a 6 month period using the quantitative and qualitative data, and the skills transfer/training data. They will be supervised by JC. Senior Co-applicants will require 5% funding to allow appropriate input at different stages of the project. **Equipment purchases:** A laptop and PowerPoint projector will be required by the clinical team for delivery of training workshops and dissemination of results. The data management team also require computing support over the 4 years of the project. Focus groups will be recorded and transcription services have been included to ensure accurate and efficient transcribing of process evaluation data. **Travel** for the user representatives and focus group participants with appropriate compensation is included as well as researcher travel to clinics during the recruitment and data collection phases Costs also include photocopying, postage, and questionnaire licensing fees

NHS support costs and Excess treatment costs

In order to ensure uniformity and accuracy of the primary outcome measures DCCT aligned HbA1c values will be used at baseline, 12 month and 24 months data collection. Excess treatment costs are estimated on the basis of one session of clinical nurse specialist time for each individual patient to take into account maximum potential delivery costs.

Trial Flow diagram



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