

Clinical Trial Protocol



Trial Title: **PRedicting Outcomes For Crohn's disease using a moLecular biomarkEr (PROFILE) trial**

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Chief Investigator: Dr Miles Parkes

CI Address: Department of Gastroenterology, Box 201A, Cambridge University Hospital, Cambridge. CB2 0QQ

Telephone: + 44 (0) 1233 245 151

Co-ordinating Centre: Cambridge Clinical Trials Unit (CCTU)
Coton House, Level 6, Box 401, Addenbrooke's Hospital, Hills Road, Cambridge. CB2 0QQ.
Telephone: +44 (0) 1223 254 666

Trial Sponsor: Cambridge University Hospitals NHS Foundation Trust and University of Cambridge

SAE Reporting: Cambridge Clinical Trials Unit (fax: 01223 254 247 / email: francis.dowling@addenbrookes.nhs.uk)

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Protocol Signatures:

I give my approval for the attached protocol entitled Predicting Outcomes for Crohn's disease using a molecule biomarker (PROFILE) trial V3.0.

Chief Investigator

Name: Dr Miles Parkes



Signature:

Date: 30/04/2018

Site Signatures

I have read the attached protocol entitled "Predicting Outcomes for Crohn's disease using a molecule biomarker (PROFILE) trial" V3.0 and agree to abide by all provisions set forth therein.

I agree to comply with the conditions and principles of Good Clinical Practice as outlined in the European Clinical Trials Directives 2001/20/EC and the GCP Directive 2005/28/EC.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the clinical investigation without the prior written consent of the Sponsor.

Principal Investigator

Name:

Signature: _____

Date: _____

Once signed please, please return a copy of this page only to the Trial coordinating office.

1 Trial Management Committee (TMG) and Protocol Contributors

Chief Investigator

Dr Miles Parkes
Department of Medicine
University of Cambridge School of Clinical Medicine
Cambridge. CB2 0QQ.
Telephone: + 44 (0) 1233 245 151
Email: miles.parkes@addenbrookes.nhs.uk

Co-Investigators

Professor Kenneth Smith (Addenbrooke's Hospital, Cambridge, United Kingdom).
Dr James Lee (Addenbrooke's Hospital, Cambridge, United Kingdom).
Dr Eoin McKinney (Addenbrooke's Hospital, Cambridge, United Kingdom).
Dr Nurulamin Noor (Addenbrooke's Hospital, Cambridge, United Kingdom).

Chief Technical Officers

Dr Paul Lyons (University of Cambridge, Cambridge, United Kingdom).
Dr Daniele Biasci (University of Cambridge, Cambridge, United Kingdom).

Trial Co-ordinator

Mr Francis Dowling (Cambridge Clinical Trials Unit, Addenbrooke's Hospital, Cambridge, United Kingdom).
Dr Harvey Leung (Cambridge Clinical Trials Unit, Addenbrooke's Hospital, Cambridge, United Kingdom).

Trial Statistician

Dr Simon Bond (Cambridge Clinical Trials Unit, Addenbrooke's Hospital, Cambridge, United Kingdom).

Trial Pharmacist

Mrs Lynne Whitehead (Addenbrooke's Hospital, Cambridge, United Kingdom).

Data Monitoring Committee

Independent chair – Dr Vipul Jairath (University Hospital, Ontario, Canada).
Independent expert statistician – Professor Robert Gray (Harvard T.H. Chan School of Public Health, Boston, Massachusetts, United States of America).
Independent expert member – Professor Severine Vermeire (Catholic University of Leuven, Leuven, Belgium).

Trial Steering Committee

Independent Chair - Professor Geert D'Haens (Amsterdam Medical Centre, Amsterdam, Netherlands).
Independent statistician - Graham Wetherill.
Independent Expert Member - Professor Gijs Van Den Brink (GlaxoSmithKline, Cambridge, United Kingdom).

Table of Contents

Protocol Signatures:	2
1 Trial Management Committee (TMG) and Protocol Contributors	3
Table of Contents	4
2 Abbreviations	6
3 Trial Synopsis	7
4 Trial Flow Chart	12
5 Introduction	13
5.1 Background.....	13
5.2 Biomarker - Preliminary work	14
5.3 Biomarker – Data development of whole blood classifier	14
6 Rationale for Trial	16
7 Trial Design	16
7.1 Statement of design	16
7.2 Number of Centres	16
7.3 Number of Participants	16
7.4 Trial objectives	17
7.5 Trial Outcome Measures.....	17
8 Selection and withdrawal of participants	17
8.1 Inclusion Criteria	17
8.2 Exclusion Criteria	18
8.3 Treatment Assignment and Randomisation Number	18
8.4 Method of Blinding	19
8.5 Participant withdrawal criteria.....	19
8.6 Early treatment termination	19
9 Trial Treatments	19
9.1 Dosage schedules	19
9.2 Presentation of the drug	22
9.3 Known drug reactions & interaction with other therapies.....	22
9.4 Dosage modifications.....	23
9.5 Drug storage and supply	24
9.6 Concomitant therapy	24
10 Procedures and assessments	24
10.1 Screening evaluation	24
10.2 Baseline assessments (Week 0)	26
10.3 Trial assessments	26
10.4 End of Trial Participation	29
10.5 Schedule of Events.....	29
10.6 Trial restrictions.....	30
11 Assessment of Safety	31
11.1 Definitions	31
11.2 Evaluation of adverse events	32
11.3 Reporting serious adverse events.....	32
11.4 Pregnancy Reporting	33
12 Toxicity – Emergency Procedures	33
13 Evaluation of Results (Definitions and response/evaluation of outcome measures)	33
13.1 Response criteria	33
14 Storage and Analysis of Samples	34
15 Statistics	34
15.1 Statistical methods	34
15.2 Health Economics.....	37

15.3	Interim analyses	37
15.4	Number of participants to be enrolled	37
15.5	Criteria for the premature termination of the trial	37
15.6	Procedure to account for missing or spurious data	37
15.7	Definition of the end of the trial	38
16	Data handling and record keeping	38
16.1	CRF	38
16.2	Source Data	38
16.3	Endoscopic Video and MRE Images	38
16.4	Data Protection & Patient Confidentiality	39
17	Data Monitoring Committee/Trial Steering Committee	39
18	Ethical & Regulatory considerations	39
18.1	Consent	39
18.2	Ethical committee review	39
18.3	Regulatory Compliance	40
18.4	Protocol Amendments	40
18.5	Peer Review	40
18.6	Declaration of Helsinki and Good Clinical Practice	40
19	Sponsorship, Financial and Insurance	40
20	Monitoring, Audit & Inspection	41
21	Protocol Compliance and Breaches of GCP	41
22	Publications policy	41
23	References	42
24	Appendices	44
24.1	Appendix 1 - Trial Management / Responsibilities	44
24.2	Appendix 2 – Authorisation of Participating Sites	45
24.3	Safety Reporting Flow Chart	47

2 Abbreviations

6-MP	6-Mercaptopurine
6-TGN	6-Thioguanine
AE	Adverse Event
Anti-TNF α	Anti-Tumor Necrosis Factor Alpha
APR	Annual Progress Report
ASR	Annual Safety Report
CA	Competent Authority
CD	Crohn's Disease
CRF	Case Report Form
CRP	C-Reactive protein
DMC	Data Monitoring Committee
DSUR	Development Safety Update Report
FBC	Full Blood Count
GCP	Good Clinical Practice
GP	General Practitioner
HBI	Harvey Bradshaw Index
IBDQ	Inflammatory Bowel Disease Questionnaire
ISF	Investigator Site File
kg	Kilogram
LFTs	Liver Function Tests
mg	Milligram
ml	Millilitre
MRE	Magnetic Resonance Enterography (or Enteroclysis)
NIMP	Non Investigational Medicinal Product
PPC	Prescription prepayment certificate
QoL	Quality of life
R&D	Research and Development
RA	Regulatory Agency
REC	Research Ethics Committee
SAE	Serious Adverse Event
SmPC	Summary of Product Characteristics
TB	Tuberculosis
TMG	Trial Management Group
TPMT	Thiopurine Methyltransferase
TSC	Trial Steering Committee
U&Es	Urea and Electrolytes
VZV	Varicella Zoster Virus

3 Trial Synopsis

<p>Title of clinical trial</p> <p>PRedicting Outcomes For Crohn's disease using a moLecular biomarkEr (PROFILE) trial.</p>
<p>Sponsor name</p> <p>Cambridge University Hospitals NHS Foundation Trust and the University of Cambridge.</p>
<p>Medical condition or disease under investigation</p> <p>Crohn's disease.</p>
<p>Purpose of clinical trial</p> <p>To demonstrate that a whole blood prognostic biomarker can be used at diagnosis to facilitate the delivery of appropriately personalised therapy in Crohn's disease, and that this improves clinical outcomes.</p>
<p>Primary objective</p> <p>To demonstrate that a whole blood prognostic biomarker can improve outcomes by facilitating the delivery of personalised therapy from diagnosis in Crohn's disease.</p>
<p>Secondary objective (s)</p> <p>To demonstrate that a whole blood prognostic biomarker can improve quality of life and health resource allocation by enabling appropriately personalised therapy to be initiated at diagnosis in Crohn's disease.</p>
<p>Trial Design</p> <p>A randomised, multi-centre, biomarker-stratified open-label trial in patients newly diagnosed with Crohn's disease.</p>
<p>Trial Outcome Measures</p> <p>Primary endpoint</p> <ul style="list-style-type: none"> Sustained surgery and steroid free remission from completion of steroid induction treatment through to week 48.

Secondary endpoints (3 assessed in parallel)

1. Mucosal healing at 1 year.
2. Quality of life assessment (IBDQ).
- 3.i Number of flares at 1 year.
- 3.ii Cumulative glucocorticoid exposure at 1 year.
- 3.iii Steroid-free remission at 1 year.
- 3.iv Number of hospital admissions and Crohn's surgeries at 1 year.

Sample Size

400 enrolled and stratified using biomarker.

Summary of eligibility criteria**Inclusion Criteria:**

- Crohn's disease diagnosed within 3 months* using standard endoscopic, histologic or radiological criteria.**
- Clinical evidence of active Crohn's disease (corresponding to an HBI \geq 7).
- Endoscopic evidence of at least moderately active Crohn's disease (corresponding to an SES-CD $>$ 6 or $>$ 4 if limited to terminal ileum).
- CRP \geq upper limit of normal on local assay **OR** Calprotectin \geq 200 μ g/g.
- Immunomodulator and anti-TNF α naïve.
- Aged 16-80 years old.

* Patients with newly-diagnosed patchy colonic inflammation, initially diagnosed as indeterminate colitis, would meet inclusion criteria for the trial if felt to be consistent with Crohn's disease.

** Patients need to have discontinued systemic corticosteroids for one week or more prior to screening assessments and still have ongoing, active disease.

Exclusion Criteria:

- Patients with ulcerative colitis.
- Patients with fistulating peri-anal Crohn's disease or active perianal sepsis.
- Patients with obstructive symptoms AND evidence of a fixed stricture on radiology or colonoscopy, which suggest that the patient is at high risk of requiring surgery over the following year. N.B. patients with modest degrees of stricturing on imaging but no obstructive symptoms may be included according to clinician judgement.
- Patients with contra-indications to trial medications including a history of hepatitis B or C, tuberculosis.
- Patients with a history of malignancy.
- Patients who are pregnant or breastfeeding at screening.
- Other serious medical or psychiatric illness currently on going, or experienced in the last 3 months, that could compromise the trial.
- Patients unable to comply with protocol requirements (for reasons including alcohol and/or recreational drug abuse).

Treatment arms

“Top-Down” therapy

- 8 week reducing course of Prednisolone started at screening, see section 9.1.1. The rate of weaning should be accelerated once Infliximab is commenced from a reduction of 5mg/week to 10mg/week.
- Anti-TNF α Infliximab started 2 weeks after randomisation and one of the following immunomodulatory medications; Azathioprine OR 6-Mercaptopurine and Allopurinol OR Methotrexate, see section 9.1.1. If initial disease flare has not adequately responded by third dose of Infliximab at week 8 (HBI \geq 7) then an additional one-off dose of Infliximab should be given at week 12 if pre-dose Infliximab serum levels from week 8 are below 20 μ g/ml.
- Disease flares: 8 week reducing course of Prednisolone, see section 9.1.1.

“Accelerated Step-Up” therapy

- 8 week reducing course of Prednisolone started at screening, see section 9.1.1. If at baseline visit, patient remains significantly symptomatic from active Crohn’s disease (fall of HBI $<$ 3 AND HBI \geq 7) then an *ad hoc* visit should be arranged for week 2, with a view to moving onto Flare 1 step, as described below.
- Flare 1: 12 week reducing course of Prednisolone, see section 9.1.1., and one of the following medication options; Azathioprine OR 6-Mercaptopurine and Allopurinol OR Methotrexate, see section 9.1.1. If symptoms remain refractory to the 12 week course of Prednisolone and immunomodulator (fall of HBI $<$ 3 AND/OR HBI \geq 7) or if the disease re-flares, the participant should be escalated as per Flare 2 step.
- Flare 2: Add in Infliximab, see section 9.1.1. If the disease flare has not adequately responded by third dose of Infliximab (HBI \geq 7) then an additional one-off dose of Infliximab should be scheduled to take place four weeks after this third dose. This additional visit should then take place if pre-dose Infliximab serum levels from third infusion visit are confirmed to be below 20 μ g/ml.
- Flare 3+ (i.e. disease flare after Infliximab dose optimisation as above): 8 week reducing course of Prednisolone, see section 9.1.1.

Routes of administration

Infliximab - Intravenous infusion.

Azathioprine – Oral tablet.

6-Mercaptopurine – Oral tablet.

Allopurinol – Oral tablet.

Methotrexate – Subcutaneous injection or oral tablet.

Prednisolone – Oral tablet.

Maximum duration of treatment of a participant

Participants will follow the treatment regimens for the duration of the trial (approximately 50 weeks).

Procedures

Screening Visit (Week -2)

Consent, physical examination, HBI, pregnancy test (for women of child-bearing age), blood sample for PAXgene tube x2 (biomarker assessment & research sample), serum tube, EDTA tube, blood samples (FBC, CRP, VZV, U&E, Creatinine, LFT, TPMT, Hepatitis B, Hepatitis C, Tuberculosis*), sample pot for faecal Calprotectin provided, buffered stool sample, and start reducing course of Prednisolone (8 week course). Colonoscopy result. MRE should be arranged if not already performed.

* Tuberculosis testing can be performed by T cell ELISA (e.g. Quantiferon Gold) or Chest X-ray or both, as per local preference. Results within 1 year of the baseline assessment are acceptable.

Baseline (Week 0) - i.e. 2 weeks after Screening visit +/- 5 days

)

Eligibility confirmation, medication review, physical examination, medical history and adverse event review, HBI, weight and patient rated questionnaires. Blood tests. Randomisation of treatment allocation to either "Accelerated Step-Up" or "Top-Down" group.[†]

Week 4 (+/- 10 days)

Physical examination, HBI, weight, adverse event, medication review and blood tests.

Weeks 16 & 32 (+/- 10 days)

As per week 4 visit, plus blood sample for PAXgene tube, serum tube, sample pot for faecal Calprotectin, and patient rated questionnaires.

Weeks 48 (+/- 10 days)

As per week 16 and 32 visit, plus buffered stool sample. End of trial procedures to be arranged (colonoscopy and MRE).

Ad hoc visits

Ad hoc visits for symptoms lasting at least one week in between scheduled trial visits. Similar to week 4 visit, stool sample for microscopy, culture and sensitivity, and stool for faecal calprotectin (if treatment escalation for active disease, otherwise no faecal calprotectin sample required) and patient rated questionnaires.

[†]Participants in the "Top-Down" group should be started on Infliximab within 2 weeks (+/- 7 days) after treatment allocation. This will align trial visits and dates of Infliximab infusion, to minimise extra visits.

Treatment period

The treatment period will be approximately 50 weeks. Following the trial treatment period, patients will resume standard care and be managed by their local clinicians.

End of Trial

Participants will complete their involvement in the trial approximately 50 weeks after the baseline visit.

Procedures for safety monitoring during trial

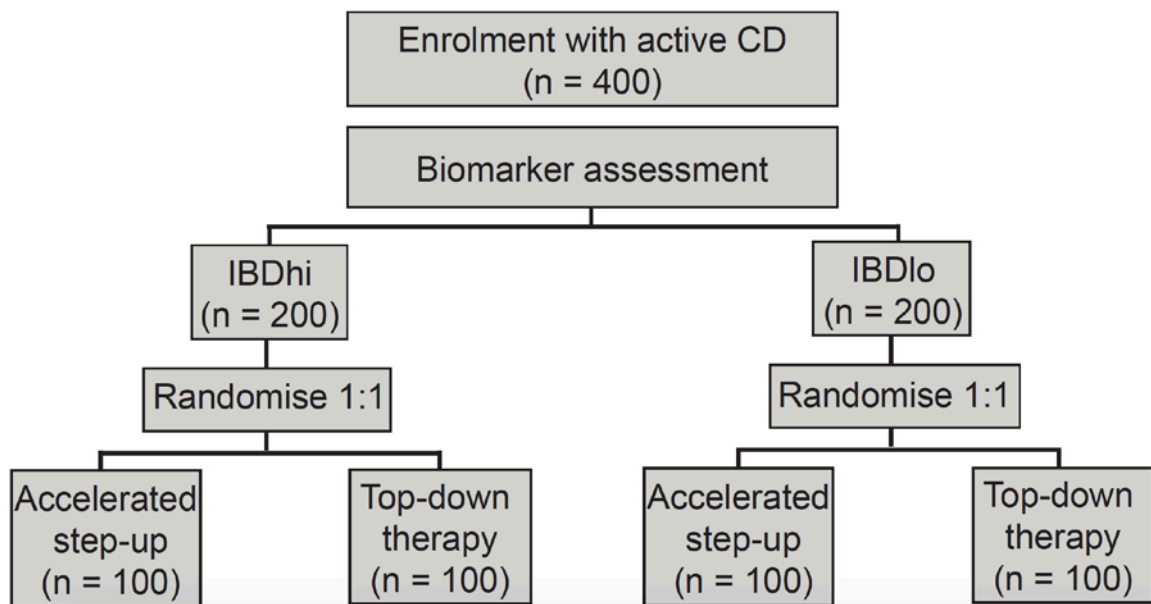
Monitoring for adverse events at each scheduled trial visit.

Criteria for withdrawal of participants

Each individual has the right to discontinue their participation in the trial at any time. If a participant wishes to discontinue, anonymised data collected up until that point will be included in the analysis.

For participants with non-response to Infliximab, please see section 9.4.

4 Trial Flow Chart



5 Introduction

5.1 Background

Crohn's disease (CD) is a relapsing-remitting form of inflammatory bowel disease (IBD) that can affect any part of the intestinal tract, most commonly the ileum and the colon. It is a common condition, affecting at least 115,000 people in the United Kingdom, and typically presents in early adulthood. Crohn's disease is a lifelong disease and is associated with symptoms including abdominal pain, diarrhoea, fatigue and weight loss. Up to 50% of patients may require surgery in the first 5-10 years after diagnosis.

Like many other immune-mediated diseases, the course of Crohn's disease varies substantially between affected individuals, but no reliable prognostic markers exist. The most common treatment strategy in Crohn's disease is based on a stepwise escalation in therapy, but only in response to recurrent flares or persistently active disease. This strategy (termed "Step-Up") should not over-treat patients but could expose some to avoidable complications of persistently active disease (while weaker and potentially ineffective therapies are trialled). For this reason, other treatment strategies have been proposed.

In 2008, it was shown that early use of anti-TNF α therapy ("Top-Down") was superior to conventional "Step-Up" management (D'Haens et al. Lancet 2008). Further support came from the 'study of biologic and immunomodulator naive patients in Crohn's disease' (SONIC) trial, which demonstrated that combining anti-TNF α (Infliximab) with Azathioprine achieved results superior to either alone (Colombel et al. NEJM 2010). However, it was widely recognised that the indiscriminate use of combination therapy in all patients would be (1) unaffordable and (2) risky – exposing patients with mild disease to the side effects of drugs that their disease did not require.

Since 2010, investigators have focused on whether accelerating more quickly up the treatment ladder ("Accelerated Step-Up"; REACT trial, Khanna et al. Lancet 2015) or using more affordable, but less potent, drugs (e.g. Azathioprine) at diagnosis in all patients would lead to better outcomes (AZTEC trial, Panes et al. Gastroenterology 2013; RAPID trial, Cosnes et al. Gastroenterology 2013). However, none of these trials demonstrated improved efficacy over standard care, leading many to conclude that a "precision" (or "personalised") approach is required. This conclusion stems from the fact that the course of Crohn's disease varies substantially between patients, and thus is a major confounder in trials of treatment strategies. For all the work in recent years investigating clinical, genetic and serological markers, there are currently no prognostic tools for Crohn's disease in clinical practice that can reliably predict the severity of the disease course from diagnosis.

To understand the importance of these issues to practicing gastroenterologists, a survey was conducted in the UK (n=50) and US (n=52), which showed that the majority of US and UK gastroenterologists recognised an unmet need for an assay that could predict the clinical outcome and probability of relapse in Crohn's disease (UK 98%, US 94%). 54% of UK and 58% of US gastroenterologists would use such a test in their patients even if they could not change treatment in response to the results. If the results of the prognostic biomarker did enable gastroenterologists to tailor their treatment approach, 100% of the UK and US gastroenterologists sampled reported they would use the test.

5.2 Biomarker - Preliminary work

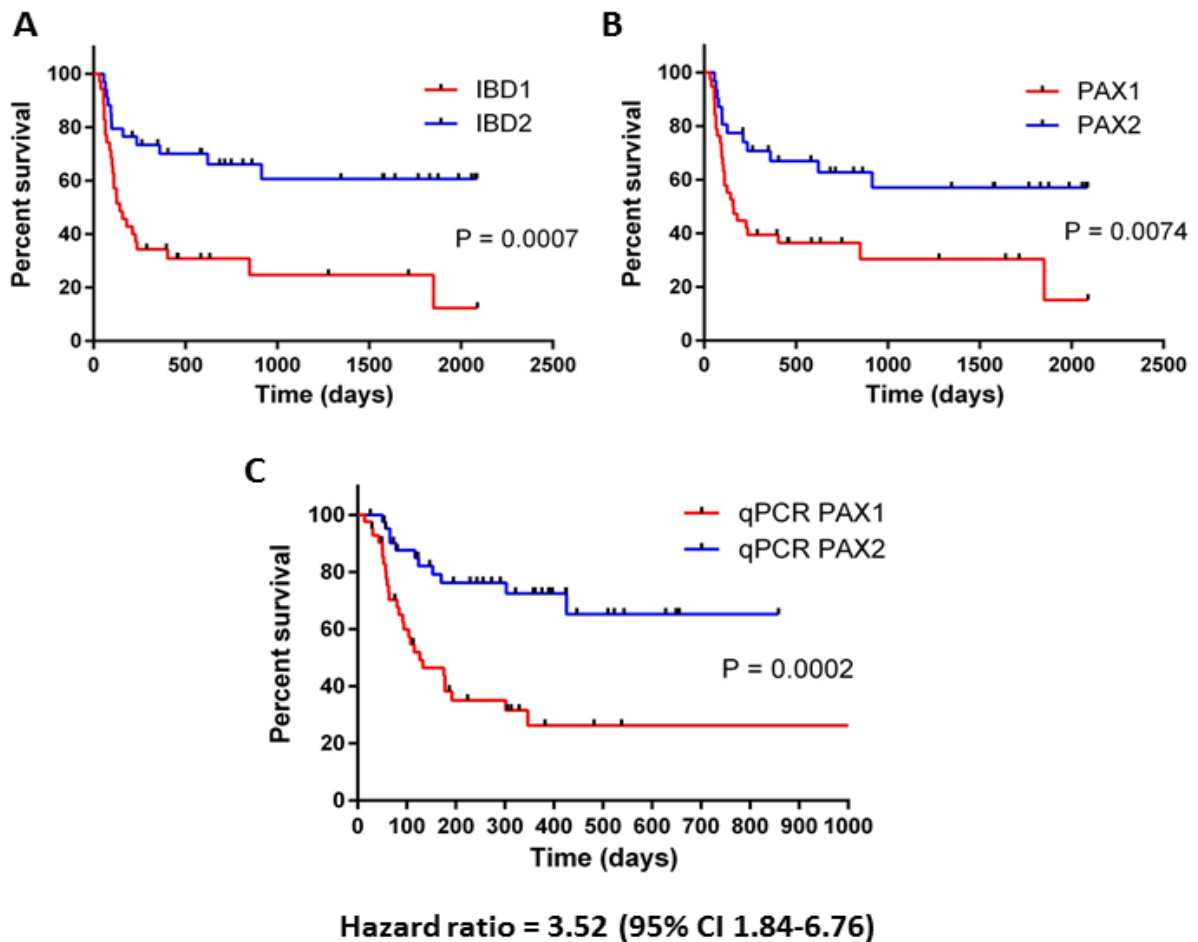
Previously, a transcriptional biomarker has been identified that is detectable within peripheral blood CD8 T cells from patients with active, untreated inflammatory bowel disease, as well as in other autoimmune diseases (Lee et al. JCI 2011, McKinney et al. Nature Med 2010). This gene expression signature was detectable at diagnosis and stratified all IBD patients into 2 clinically indistinguishable subgroups (termed "IBD1" and "IBD2"). Detailed, prospective follow-up demonstrated that patients within these subgroups experienced significantly different disease courses (Figure A). Those in the IBD1 subgroup had a high incidence of treatment-refractory, relapsing disease, while those in the IBD2 subgroup typically achieved stable remission on minimal immunosuppression. The prognostic stratification that was achieved using this biomarker was superior to that observed using previously described methods, including clinical parameters and ASCA serology.

To validate this observation, a further 51 patients were recruited with newly diagnosed IBD. Analysis of their CD8 T cell transcriptomes replicated the prognostic stratification observed in the initial dataset, providing independent validation of the signature and its ability to predict disease outcome (data on file). Overall performance: Hazard ratio 3.53 (95% confidence intervals: 2.09 - 5.93), $P < 0.0001$ (escalation-free survival); mean number of escalations 1.41 (IBD1), 0.69 (IBD2), $P = 0.0001$, Relative Risk = 2.03 (total number of escalations during follow up - median 3.5 years in both subgroups), $n = 118$.

5.3 Biomarker – Data development of whole blood classifier

A whole blood qPCR assay has now been developed and validated that re-capitulates the IBD1/IBD2 subgroups, which were originally termed PAX1 and PAX2 respectively (Figures A and B), and have now been re-named IBD^{hi} and IBD^{lo}. This classifier demonstrates an equivalent association with disease course, both in terms of escalation-free survival ($P = 0.0074$) and number of escalations over time ($P = 0.0003$, mean number of treatment escalations: 1.62 (IBD^{hi}), 0.70 (IBD^{lo})). The genes in this classifier were taken forward to real time PCR assay development, where the final content of the whole blood classifier (16 informative and 2 reference genes) was optimised and finalised.

Independent validation of the prognostic performance of this classifier was then sought using a second, independent cohort of 85 newly diagnosed IBD patients. Analysis of whole blood gene expression using the qPCR-based test replicated the prognostic stratification seen in the discovery cohort with a IBD^{hi}/IBD^{lo}. Hazard ratio of 3.52 (95 percent CI: 1.84 6.76, $P = 0.0002$, Figure C). In the training cohort the ratio of IBD^{hi}:IBD^{lo} was 35:34. In the validation cohort the ratio of IBD^{hi}:IBD^{lo} was 42:43.



Development and validation of whole blood qPCR classifier

(**A and B**) Classifier development: Kaplan-Meier survival curves demonstrating the proportion of IBD patients in the training phase of classifier development ($n = 69$) who did not require a treatment escalation (immunomodulator or surgery) during 4 years' prospective follow up, as stratified by CD8 T cell IBD1/2 subgroup (**A**) and whole blood qPCR assay (**B**). (**C**) Kaplan-Meier curve demonstrating the performance of the qPCR classifier in an independent cohort of 85 newly diagnosed IBD patients recruited from 4 UK centres.

6 Rationale for Trial

The hypothesis is that biomarker-driven stratification will facilitate personalised therapy in Crohn's disease, and will improve clinical care. It will do this through identification of a group of patients destined to develop a more severe, relapsing course and who will benefit from "Top-Down" therapy while protecting those patients destined to experience indolent disease from the risks and side-effects of unnecessary immunosuppression.

7 Trial Design

7.1 Statement of design

This is a randomised, multi-centre, biomarker-stratified, open-label trial in patients newly diagnosed with Crohn's disease (enrolled within 3 months of diagnosis).

This is an established trial design for the validation of predictive biomarkers, (Friedlin et al. J Natl Cancer Inst 2010) which has been used extensively in oncology settings (Potti et al. NEJM 2006). Participants will be randomised to either "Top-Down" or "Accelerated Step-Up" therapy.

7.2 Number of Centres

The trial will be conducted in approximately 50 centres in the United Kingdom.

7.3 Number of Participants

400 participants will be randomised in this trial.

7.3.1 Participants Trial duration

Participants will be followed-up for approximately 50 weeks from the baseline visit. There will be a total of 5 mandatory trial visits, during which data will be collected for participants in both treatment arms.

In addition to planned trial visits, participants within both arms of the trial may be seen *ad hoc* as required to manage disease flares or issues relating to drug therapy.

Trial visits will take place at the same time points for both treatment arms of the trial. These have been timed to coincide with Infliximab infusion visits where possible (for those who are randomised to "Top-Down").

For participants randomised to "Accelerated Step-Up" treatment, if disease progression requires treatment escalation to Infliximab, this will be undertaken at standard intervals i.e. weeks 0, 2, 6 and 8 weekly thereafter.

Future data collection will also take place following completion of the randomised treatment to assess disease burden and the longer term impact of "Top-Down" vs. "Accelerated Step-Up" treatment approaches on subsequent disease course. This will be based on questionnaire data and clinical assessment.

7.4 Trial objectives

7.4.1 Primary objective

- To demonstrate that a whole blood prognostic biomarker can improve clinical outcomes by facilitating the delivery of personalised therapy from diagnosis in Crohn's disease.

7.4.2 Secondary objective

- To demonstrate that a whole blood prognostic biomarker can improve quality of life and health resource allocation by enabling appropriately personalised therapy to be initiated at diagnosis in Crohn's disease.

7.5 Trial Outcome Measures

7.5.1 Primary outcome measure

Incidence of sustained surgery and steroid free remission from completion of a standard (8 week regimen) steroid induction treatment through to week 48*.

*remission = HBI \leq 4. Requirement for a course of systemic glucocorticoids for active Crohn's disease would result in failure to meet primary outcome measure.

7.5.2 Secondary outcome measure

1. Mucosal healing (at 1 year).
2. Quality of life assessment (IBDQ).
- 3.i Number of flares at 1 year.
- 3.ii Cumulative glucocorticoid exposure at 1 year.
- 3.iii Steroid free remission at 1 year.
- 3.iv Number of hospital admissions and Crohn's surgeries at 1 year.

8 Selection and withdrawal of participants

8.1 Inclusion Criteria

Patients to be included in the trial must meet the following criteria:

- Crohn's disease diagnosed within 3 months* using standard endoscopic, histologic or radiological criteria.**
- Clinical evidence of active Crohn's disease (corresponding to an HBI \geq 7).
- Endoscopic evidence of at least moderately active Crohn's disease (corresponding to an SES-CD $>$ 6 or $>$ 4 if limited to terminal ileum).
- CRP \geq upper limit of normal on local assay **OR** Calprotectin \geq 200 μ g/g.
- Immunomodulator and anti-TNF α naïve.
- Aged 16-80 years old.

* Patients with newly-diagnosed patchy colonic inflammation, initially diagnosed as indeterminate colitis, would meet inclusion criteria for the trial if felt to be consistent with Crohn's disease.

** Patients need to have discontinued systemic corticosteroids for one week or more prior to screening assessments and still have ongoing, active disease.

Colonoscopy results used for confirming inclusion can be from the participants index colonoscopy performed as part of their standard care as long as it is within 3 months of the baseline visit. Ideally however, a video of the index colonoscopy should be recorded wherever possible.

8.2 Exclusion Criteria

The presence of any of the following will preclude patient inclusion:

- Patients with ulcerative colitis.
- Patients with fistulating peri-anal Crohn's disease or active perianal sepsis.
- Patients with obstructive symptoms AND evidence of a fixed stricture on radiology or colonoscopy, which suggest that the patient is at high risk of requiring surgery over the following year. N.B. patients with modest degrees of stricturing on imaging but no obstructive symptoms may be included according to clinician judgement.
- Patients with contra-indications to trial medications.
- Patients with blood results that contra-indicate the medications used in the trial.
- Patients who are pregnant or breastfeeding at baseline.
- Other serious medical or psychiatric illness currently on going, or experienced in the last 3 months, that could compromise the trial.
- Patients unable to comply with protocol requirements (for reasons including alcohol and/or recreational drug abuse).

Patients who still have a TPMT result awaited, when they attend their baseline visit, can still be randomised if otherwise eligible. The TPMT result will need to be confirmed before the patient can start on a thiopurine. For participants who are found to be TPMT null, then the immunomodulator of choice would be Methotrexate (as described in 9.1.1).

Patients who still have a TB test result awaited, when they attend their baseline visit, can still be randomised if their chest x-ray shows no evidence of TB, they are considered low risk for development of TB, and at clinician discretion. If testing for TB subsequently returns as positive, then the participant should be withdrawn from the trial.

8.3 Treatment Assignment and Randomisation Number

Following biomarker assessment, participants in each biomarker subgroup will be randomly assigned (1:1) to either "Top-Down" or "Accelerated Step-Up" therapy, using a computer-generated algorithm. This will occur 14 days after screening (plus or minus 5 days).

Stratified block randomisation will be used, stratifying on biomarker subgroup, (IBD^{hi}/IBD^{lo}), mucosal inflammation (mild / moderate / severe) and disease location (colon-only/other) with a randomly generated block size.

8.4 Method of Blinding

All treatments will be open label. Clinicians and participants will, however, be blinded to biomarker subgroup allocation.

8.5 Participant withdrawal criteria

Each patient has the right to discontinue their participation in the trial at any time. If a patient asks to be withdrawn a partial withdrawal may be offered.

Partial withdrawals are allowed. E.g. patient no longer wishes to complete questionnaires but is happy to continue otherwise.

All withdrawals and partial withdrawals will be documented. If a patient wishes to discontinue, anonymised data collected up until that point will be included in the analysis.

8.6 Early treatment termination

All participants are expected to remain in the trial with medical management of their Crohn's disease as protocolised, until the final scheduled visit at week 48.

Participants will be reviewed at each visit and early treatment termination will be at the discretion of the participant and local treating team, if felt that early treatment termination is in the participant's best interests.

If early treatment termination occurs, this should be documented as a partial withdrawal and all remaining follow up visits should be completed as normal.

9 Trial Treatments

For the purposes of this trial, all the drugs to be used are classed as Non-Investigational Medicinal Products (NIMPs):

Prednisolone
Infliximab
Adalimumab
Azathioprine
6-Mercaptopurine
Methotrexate
Allopurinol
Folic acid
Chlorphenamine

9.1 Dosage schedules

"Top-down" therapy

- 8 week reducing course of Prednisolone started at screening, see section 9.1.1. The rate of weaning should be accelerated once Infliximab is commenced from a reduction of 5mg/week to 10mg/week.
- Infliximab started within 2 weeks after randomisation (+/- 7 days) **plus** one of the following immunomodulatory medications; Azathioprine OR 6-Mercaptopurine and Allopurinol OR Methotrexate and Folic acid, see section 9.1.1. Immunomodulatory medications will continue until end of trial. If participants are either severely or persistently intolerant of Infliximab, they may be switched onto Adalimumab (see section 9.1.1).
- Disease flares: Add in 8 week reducing course of Prednisolone, see section 9.1.1. For clarity, non-response to Infliximab after the 3 induction doses should not be classed as a disease flare and does not mandate a course of steroids at this stage, but rather the management plan as described below.

* For participants in the "Top-Down" group with non-response to Infliximab (HBI \geq 7 at the 3rd dose of Infliximab) a blood sample for Infliximab trough drug level should be taken and an additional dose of Infliximab will be provisionally scheduled for trial week 12, see section 9.4.

This additional Infliximab infusion should only be given if pre-dose Infliximab levels, taken at the 3rd infliximab infusion date, are confirmed to be less than 20 μ g/ml and the disease remains active at week 11 (checked via telephone consultation). Participants with persistent non-response after week 16, should have early treatment termination, with end of trial procedures performed and revert back to standard care with their local clinical team (see section 8.6).

The need for a course of steroid treatment for active Crohn's disease, once the patient has completed Infliximab induction therapy and is on the maintenance regimen, means that they have failed to meet the primary outcome measure.

"Accelerated Step-Up" therapy

- 8 week reducing course of Prednisolone started at screening, see section 9.1.1. If at baseline visit, patient remains significantly symptomatic from active Crohn's disease (fall of HBI $<$ 3 AND HBI \geq 7) then an *ad hoc* visit should be arranged for week 2, with a view to moving onto Flare 1 step, as described below.
- Flare 1: 12 week reducing course of Prednisolone, see section 9.1.1., and one of the following medication options; Azathioprine OR 6-Mercaptopurine and Allopurinol OR Methotrexate, see section 9.1.1. If symptoms remain refractory to the 12 week course of Prednisolone and immunomodulator (fall of HBI $<$ 3 AND/OR HBI \geq 7) or if the disease re-flares, the participant should be escalated as per Flare 2 step.
- Flare 2: Add in Infliximab, see section 9.1.1. If the disease flare has not adequately responded by third dose of Infliximab (HBI \geq 7) then an additional one-off dose of Infliximab should be scheduled to take place four weeks after this third dose. This additional visit should then take place if pre-dose Infliximab serum levels from third infusion visit are confirmed to be below 20 μ g/ml.

- Flare 3+ (i.e. disease flare after Infliximab dose optimisation as above): 8 week reducing course of Prednisolone, see section 9.1.1.

9.1.1 Route of Administration and Maximum dosage allowed

Prednisolone

Reducing course over an 8 week period: Prednisolone 40mg to be taken daily, reducing by 5mg every week to 0mg. If during the reducing course, participants experience a sustained deterioration of symptoms attributed by the local PI to a flare of Crohn's disease (fall of HBI <3 AND HBI ≥ 7) the participant will move to the next "Step" if on "Accelerated Step-Up" treatment (i.e. Flare 1: 12 week reducing course of Prednisolone starting at 40mg/day and reducing by 5mg/week to 20mg/day then 5mg every 2 weeks to 0 **plus** starting an immunomodulator).

Oral vitamin D and calcium replacement should be prescribed as per local hospital guidelines, whilst on reducing regimen of Prednisolone.

Azathioprine

For participants with normal TPMT activity who are aged less than 65 years old, Azathioprine 2.5mg/kg oral tablet(s) to be taken daily. It is recommended for the PROFILE trial that participants start on a 2.5mg/kg dose. However, if dose escalation is to be performed then participants can be started on 50mg per day for 2 weeks to ensure tolerance, before directly escalating to this 2.5mg/kg dose.

For participants with intermediate TPMT activity this dose should be halved. Participants with complete TPMT deficiency or aged >65 years old, should not receive Azathioprine, and should ideally receive Methotrexate instead. Specific dosing may vary from the exact calculated dosing due to tablet configurations (dose rounding/tablet splitting/alternate day dosing to be guided as per local practice). Dosing may be adjusted based on metabolite levels, see section 9.4.

Azathioprine intolerance

Participants who are intolerant of Azathioprine should be started on either Methotrexate or low dose 6-Mercaptopurine with Allopurinol (details below) as per the preference of the local Investigator, unless Azathioprine-induced pancreatitis occurred in which case Methotrexate must be used.

Low Dose 6-Mercaptopurine (6-MP) & Allopurinol combination

For participants who are intolerant of Azathioprine (for reasons other than pancreatitis) or who preferentially metabolise Azathioprine to 6-MMP: start Allopurinol 100mg oral tablet(s) and 6-Mercaptopurine 0.3-0.4mg/kg oral tablet(s) to be taken daily (dose rounding/tablet splitting/alternate day dosing to be guided as per local practice). Specific dosing may vary from the exact calculated dosing due to tablet configurations. The combination of Allopurinol and low dose Mercaptopurine is safe provided appropriate monitoring, including therapeutic drug monitoring (Smith et al. J Crohns Colitis 2012). Dosing may be adjusted, please see section 9.4. Women of child-bearing age or men who are sexually active receiving Allopurinol must use contraception.

Methotrexate & Folic acid combination

For participants who are TPMT null, or older than 65 years, or who develop Azathioprine-induced pancreatitis, Methotrexate 15-25mg is to be taken weekly (no titration), either as oral tablet(s) or subcutaneous injection. Lower doses may be required if any evidence of impaired renal or liver function. Women of child-bearing age

or men who are sexually active receiving Methotrexate must use contraception. Folic acid should be taken as an oral tablet for participants on Methotrexate, the dosing of Folic acid should be as per standard practice at local hospital.

Anti-TNF α Infliximab

For participants in the "Top-Down" group, Infliximab 5mg/kg to be infused intravenously, over a period of up to 2 hours. Following first infusion, subsequent infusions will be at 2 weeks after (+/- 7 days), then 6 weeks after the first infusion (+/- 7 days), and then infused 8 weekly thereafter (+/- 7 days), i.e. standard induction and treatment regimen for Infliximab. Exact dosing may vary slightly from the calculated dose e.g. dose may be rounded up or down in line with local practice.

Chlorphenamine and Hydrocortisone

If participants develop a non-severe infusion reaction following administration of Infliximab, or experience other mild allergic symptoms, then all subsequent infusions should be delivered at a slower rate and pre-treatment given as per local guidelines, typically including Chlorphenamine at a 20mg dose delivered intravenously, prior to the Infliximab infusion. One-off doses of Hydrocortisone as pre-treatment can be given, but this is at the discretion of the local treating team and should not be given routinely with each infusion.

Anti-TNF α Adalimumab

If participants are either severely intolerant of Infliximab or experience persistent intolerance despite a slower infusion rate and pre-treatment as per local guidelines, then they can be switched onto Adalimumab only after discussion with the Chief Investigator. This is delivered subcutaneously every two weeks. First dose is 160mg, second dose is 80mg and all further doses are 40mg.

9.1.2 Maximum duration of treatment of a participant

Participants will follow the medication regimen they are randomised to for the duration of the trial (approximately 50 weeks from baseline). At the end of the trial, treatment for participants will be at the discretion of their treating clinician and funded locally, as per usual clinical practice.

9.1.3 Procedures for monitoring participant compliance

For all medications except Infliximab, participants would take home their treatments and self-administer at appropriate time intervals. Participants would be asked to return unused medications at each visit to be checked against the anticipated amount. Tablet/subcutaneous syringe count will be reviewed at each trial visit time point.

9.2 Presentation of the drug

UK and EU-licensed standard commercial stock will be used for all NIMPs.

9.3 Known drug reactions & interaction with other therapies

Prednisolone SmPC (Pevanti 10mg) dated 15-Jun-2017

Infliximab SmPC (Remicade 100mg powder) dated 07-Nov-2016

Adalimumab SmPC (Humira 40mg/0.4ml solution) dated 26-Jul-2017

Azathioprine SmPC (50mg Tablets) dated 14-Jul-2016

6-Mercaptopurine (50mg Tablets) SmPC dated 01-Dec-2016

Methotrexate (Maxtrex Tablets 10 mg) SmPC dated 16-Sep-2014
Allopurinol (100mg Tablets) SmPC dated 26-May-2017
Folic acid (Folic Acid Tablets BP 5 mg) SmPC dated 24-Jun-2016
Chlorphenamine (Boots 4mg Tablets) SmPC dated 19-May-2015

9.4 Dosage modifications

Prednisolone

For participants in the "Top-down" treatment arm, the rate of weaning of the Prednisolone course should be increased from a reduction of 5mg/week to a reduction of 10mg/week once start Infliximab in order to minimise the amount of time any "Top-Down" participant might be receiving triple immunosuppression. Antibiotic prophylaxis whilst on triple immunosuppression can be used at clinician discretion, according to local practice.

Azathioprine and 6-Mercaptopurine

Dosing may be adjusted for weight, TPMT levels, white blood count or following measurement of 6-TGN and 6-MMP levels with targets as per normal reference ranges of local laboratory (e.g. 6-TGN levels approximately 235-450pmol/8 x 10⁸).

If participants taking Azathioprine develop intolerable side-effects, either Methotrexate or low dose 6-Mercaptopurine and Allopurinol should be prescribed instead, unless the side-effects relate to pancreatitis (clinical presentation consistent, raised amylase or lipase, or imaging findings). If this occurs, Methotrexate should be prescribed instead (if no contra-indication). If intolerant of second-line immunomodulator (Methotrexate or low dose 6-Mercaptopurine and Allopurinol) then patient should escalate to Infliximab.

Infliximab

Participants in the "Top-Down" group with sub-optimal response to Infliximab (HBI \geq 7 at 3rd infliximab infusion date), should be provisionally booked for an additional Infliximab infusion (5mg/kg) to occur 4 weeks later (+/- 10 days). This infusion will be given if the trough Infliximab level, from date of 3rd Infliximab infusion, is less than 20µg/ml and the disease remains active at week 11 (confirmed via telephone consultation). If non-response to Infliximab persists after week 16 the participant should have early treatment termination (see section 8.6). Treatment costs and management decisions outside the trial protocols will revert back to the treating clinician and respective local funding.

If mild intolerance to Infliximab (including non-severe infusion reactions or other mild allergic symptoms such as flushing, rash, itch, urticaria, fatigue, and/or headaches) then the next infusion should be infused at a slower rate and pre-treatment with intravenous chlorpheniramine 20mg should be used. Hydrocortisone should not routinely be given with Infliximab, however one-off doses can be administered at the discretion of the local treating team. If symptoms of intolerance persist, patient should be switched onto Adalimumab only after discussion with the Chief Investigator. For participants with a severe allergic reaction to Infliximab, such as bronchospasm, upper airway oedema, or hypotension, Infliximab should be stopped and patient should be considered to commence on Adalimumab, only after discussion with the Chief Investigator (see section 9.1.1).

Legal status of the drug

All medications included within the PROFILE trial are licensed medications and all are being widely used in the setting of Crohn's Disease within the UK and Europe.

9.5 Drug storage and supply

Infliximab and Adalimumab

Commercial supply of Infliximab will be available to order from the pharmaceutical company used by the trial team. This will be available free of charge to recruiting hospitals for participants taking part in the PROFILE trial. A trial order code will be supplied to pharmacies, which they will need to order against to receive the free rate.

Infliximab costs will only be covered for up to a maximum of 9 separate infusions per participant over the course of the trial. For the first order of Infliximab for the first participant recruited by each trial site, the trial co-ordinator will be required to approve the order. This stock will be stored in pharmacies as per the SmPC.

For participants who require Adalimumab due to Infliximab intolerance, this will be paid for by the lead site in Cambridge, over the course of the trial. Storage of this medication will be in line with the SmPC.

Azathioprine, 6-Mercaptopurine, Allopurinol, Methotrexate, Folic acid, Prednisolone and Chlorphenamine

The following medications; Azathioprine, 6-Mercaptopurine, Allopurinol, Methotrexate, Folic acid, Prednisolone and Chlorphenamine will be prescribed as per standard practice from either local hospital stock or in the community. Local arrangements should be made to ensure the cost of these medications are NOT met by the trial participant. This can be either through issue of a prescription prepayment certificate (PPC) to participants at the randomisation visit or reimbursement of the cost of prescriptions, or any other suitable alternative.

These medications will be collected by participants, as per arrangements at their local hospital. They will be collected from a hospital pharmacy or community pharmacy, following prescription by the clinician managing their Crohn's Disease.

Storage of all medications will be in line with the SmPC.

9.6 Concomitant therapy

Apart from the trial treatments allocated at randomisation, all other aspects of patient management are at the discretion of the participants' clinicians.

10 Procedures and assessments

Assessments and data collection will be performed, according to the schedule of events, by appropriately trained and qualified research staff as delegated by the Principal Investigator. This could include members of the Clinical Research Network teams.

At each trial visit safety/AE/SAE review will take place and treatment compliance will be reviewed.

10.1 Screening evaluation

10.1.1 Identification of potential participants

Potential trial patients with newly diagnosed Crohn's Disease will be identified by a member of the clinical team. Potentially eligible participants will be given a Participant Information Sheet (PIS). Some potential patients may be due to have their colonoscopy

procedure to take place when seen by member of clinical team. Consent for video-recording of colonoscopy should be obtained as routine for any patient due to undergo a colonoscopy procedure (for later evaluation as part of the trial).

For any hospitals that do not have facilities in place for video recording colonoscopy, the lead site in Cambridge will supply equipment if required to make this possible e.g. video capture USB sticks and external video capture devices.

10.1.2 Screening assessments

Trial specific assessments will only be conducted after patients have given written informed consent.

All participants will be screened for eligibility based on the inclusion/exclusion criteria outlined in Section 8.1 and 8.2. The screening assessments required are;

Patient data to collect

- Gender.
- Date of birth.
- HBI.
- Weight in Kg.
- Results of colonoscopy performed within 3 months of the baseline screening assessment visit (including video-recording of procedure where possible).
- Results and images of MRE if performed within 3 months of screening visit.
- IBDQ & EQ-5D, patient rated quality of life measures.

Samples to be collected and processed **locally**

- Results of hepatitis B & C and Varicella Zoster Virus blood test, results within 1 year of the baseline assessment are acceptable.
- Results of tuberculosis (TB) testing (TB testing as per local preference and Chest X-ray) results within 1 year of baseline assessment are acceptable.
- Pregnancy test for female participants.
- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests, TPMT, CRP).

Samples to be collected and sent, to be processed **centrally**

- PAXgene RNA tube x2 (biomarker assessment & research sample), Serum tube, EDTA tube
- Stool sample for faecal Calprotectin.
- Buffered stool sample (advise patient to collect same day as screening visit and ideally before starting steroid treatment).

Participants will be registered and a trial number will be assigned. Patients must have active disease ($HBI \geq 7$) and not be on any glucocorticoid or immunomodulator treatment at time of recruitment. Patients who have been diagnosed within the last 3 months and have already completed a reducing regimen of glucocorticoids would be eligible for inclusion if their disease remains active.

An 8 week reducing course of Prednisolone will be started at screening. This is to ensure any potential participants are not left with active disease without any form of treatment prior to randomisation.

Participants should be routinely called by their local treating team approximately three working days after their screening visit to ensure the stool samples have been sent, in the provided delivery safeboxes.

10.1.3 Participant Randomisation

Clinical details will be documented on a CRF and baseline samples obtained.

After analysis of PAXgene biomarker assay sample, participants will be assigned to either IBD^{hi} or IBD^{lo} groups. Patients will then be randomised using a stratified block randomisation technique via a web based system, to either “Top-Down” or “Accelerated Step-Up” therapy and their trial site will be informed of treatment allocation.

If patients cannot be assigned a IBD^{hi} or IBD^{lo} subgroup, following analysis of their PAXgene sample, then they will be excluded from the trial. Trial sites will also be informed if patient has been excluded from the trial due to presence of exclusion criteria, highlighted in 9.2.

10.2 Baseline assessments (Week 0)

Patient data to collect:

- HBI
- Significant past medical history. †
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.
- IBDQ & EQ-5D, patient rated quality of life measures.
- Resource usage, patient questionnaire.

Samples to be collected and processed **locally**:

- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests, and CRP).

†Previous/current malignancy, previous/current tuberculosis, previous/current hepatitis B virus, previous/current hepatitis C virus, significant mental health history including alcohol or drug abuse, this list is not exhaustive.

Definition of active disease at trial inclusion

HBI \geq 7 **AND** [active Crohn’s disease on ileocolonoscopy] **AND** [CRP \geq upper limit of normal on local assay **OR** Calprotectin \geq 200 μ g/g].

10.3 Trial assessments

Ileocolonoscopy

Video of withdrawal from ileum to be recorded, for central reading. Severity should be objectively scored by performing endoscopist using the Simple Endoscopic Score for Crohn’s Disease (SES-CD), to allow comparison with central reading assessment and aid assessment for mucosal healing. See 10.5 - schedule of events for further details.

MR enterography or enteroclysis

Entire procedure images will be used for central reading. This will be scored by central reading team; using the Magnetic Resonance Index of Activity (MaRIA) score. See 10.5 - schedule of events for further details.

10.3.1 Timing of assessments

Patients are to be seen in clinic at Baseline and weeks 4, 16, 32 and 48. All trial visits from weeks 0 to 48 should be within 10 days of schedule.

Definition of disease flares for the duration of the trial

HBI \geq 7 **AND** [CRP \geq upper limit of normal on local assay **OR** Calprotectin \geq 200 μ g/g] **AND** [Clinical opinion that symptoms are attributable to a flare of Crohn's disease].

10.3.2 Assessments at specific time points:

Week 4

Patient data to collect:

- HBI.
- Treatment compliance check.
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.

Samples to collect and to be processed **locally**:

- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests, CRP), [thiopurine metabolites if taking Azathioprine or 6-Mercaptopurine].

Week 16

Patient data to collect:

- HBI.
- Treatment compliance check.
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.
- IBDQ & EQ-5D, patient rated quality of life measures.
- Resource usage, patient questionnaire.
- Index MRE data.

Samples to be collected and processed **locally**:

- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests, CRP), [thiopurine metabolites if taking Azathioprine or 6-Mercaptopurine].

Samples to be collected and sent, to be processed **centrally**:

- PAXgene tube.
- Serum tube.
- Stool sample for faecal Calprotectin.

Week 32

Patient data to collect:

- HBI.
- Treatment compliance check.
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.
- IBDQ & EQ-5D, patient rated quality of life measure.
- Resource usage, patient questionnaire.

Samples to be collected and processed **locally**:

- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests, CRP), [thiopurine metabolites if taking Azathioprine or 6-Mercaptopurine].

Samples to be collected and sent, to be processed **centrally**:

- PAXgene tube.
- Serum tube.
- Stool sample for faecal Calprotectin.

Week 48 (end of trial visit)

Patient data to collect:

- HBI.
- Treatment compliance check.
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.
- IBDQ & EQ-5D, patient rated quality of life measures.
- Resource usage, patient questionnaire.
- Colonoscopy results & images (can be performed up to 4 weeks after week 48).
- MRE (can be performed up to 6 weeks after week 48).

Samples to be collected and processed **locally**:

- Full blood count.
- Biochemical series (including urea, creatinine, electrolytes, liver function tests), CRP), [thiopurine metabolites if taking Azathioprine or 6-Mercaptopurine].

Samples to be collected and sent, to be processed **centrally**:

- PAXgene tube.
- Serum tube.
- Buffered stool sample.
- Stool sample for faecal Calprotectin.

Ad hoc visits (for disease flares in between scheduled visits)

Patient data to collect:

- HBI.
- Treatment compliance check.
- Concomitant medications.
- Adverse events.
- Weight in Kg.
- Physical examination.

Samples to be collected and processed **locally**:

- Full blood count.

- Biochemical series (including urea, creatinine, electrolytes, liver function tests, CRP), [thiopurine metabolites if taking Azathioprine or 6-Mercaptopurine].
- Stool for microscopy, culture and sensitivity.

Samples to be collected and sent to be processed **centrally**:

- Faecal Calprotectin.

Concomitant medications

Treatments used as part of the trial protocol or to manage infusion reactions e.g. chlorphenamine, do not need to be recorded on the concomitant medications form.

10.4 End of Trial Participation

Following the end of trial visit, participants will return to the normal standard of care as defined by their local physicians. The costs of this standard care will continue under local funding and commissioning arrangements, according to local practice.

10.5 Schedule of Events

From screening to week 48, all visits are to be within 10 days of the schedule. Participants in the "Top-Down" group should be started on Infliximab 2 weeks after randomisation (+/- 7 days), subsequent infusions will be at week 2 (+/- 7 days), then at week 6 (+/- 7 days), and then infused 8 weekly thereafter (+/- 7 days), i.e. standard induction and treatment regimen for Infliximab. Dates of Infliximab infusions should be aligned to trial visits in order to minimise hospital attendance for participants.

Procedure	Screening Wk -2	Baseline Wk 0	Wk 4	Wk 16	Wk 32	Wk 48	Ad hoc
Written consent	✓						
Disease assessment - Harvey Bradshaw Index (HBI)	✓	✓	✓	✓	✓	✓	✓
Concomitant medication	✓	✓	✓	✓	✓	✓	✓
AE reporting		✓	✓	✓	✓	✓	✓
Weight in Kg	✓	✓	✓	✓	✓	✓	✓
Physical examination	✓	✓	✓	✓	✓	✓	✓
Eligibility confirmed		✓					
Randomisation		✓					
PAXgene RNA tube for biomarker assessment	✓						
PAXgene RNA tube for research sample	✓			✓	✓	✓	
Serum tube	✓			✓	✓	✓	
EDTA tube	✓						
Bloods (FBC, CRP,	✓ [†]	✓	✓	✓	✓	✓	✓

U&E, Creatinine, LFT)							
Screening (Hepatitis B & C, VZV, TPMT, TB)	✓						
Bloods (thiopurine metabolites)			✓ ^α	✓ ^α	✓ ^α	✓ ^α	✓ ^α
Faecal Calprotectin	✓	†		✓	✓	✓	✓ ^β
Buffered stool sample	✓					✓	
Stool sample for mc&s							✓
Patient rated Questionnaires	✓	✓		✓	✓	✓	✓
Ileo-colonoscopy	✓ [*]					✓	
MR enterography MRE	✓ [¥]					✓	

†Results of blood tests and faecal Calprotectin performed as part of standard care can be used for eligibility provided performed within 4 weeks of screening visit –however a repeat stool sample should still be sent for central processing (as Central lab results will be used in subsequent analyses). Sample pot for faecal Calprotectin will be provided at screening visit and patients advised to provide sample promptly so that central Calprotectin result is available at the baseline visit.

^α6-TGN and 6-MMP metabolites only to be measured if participants are taking either Azathioprine or 6-Mercaptopurine.

^βSample for faecal Calprotectin should be collected at *ad-hoc* visit for delivery to central trial team, for any instances where treatment is escalated for active Crohn's disease.

* Screening colonoscopy results can be taken from the participants index colonoscopy performed as part of their standard care within 3 months of the screening visit, although preferably a video of the colonoscopy should be recorded for central reading to allow comparison with the colonoscopy at week 48.

¥ It is anticipated that all patients newly diagnosed with Crohn's disease will undergo MRE. An MRE performed as part of standard of care can be used; and if not already performed should be undertaken within 3 months of the screening visit. The results of this index MRE will be collected at the week 16 visit. It will be used for central reading and allow comparison with MRE at week 48.

10.6 Trial restrictions

There are no dietary restrictions in the trial.

If Methotrexate or Allopurinol are part of treatment, women of childbearing potential are required to use adequate contraception for the duration of the trial and for 3 months after the completion of the trial visit/last treatment. These can include:

- Intrauterine Device (IUD).
- Hormonal based contraception (pill, contraceptive injection or implant etc.).
- Barrier contraception (condom or occlusive cap e.g. diaphragm or cervical cap with spermicide).
- True abstinence (where this is in accordance with the patients preferred and usual lifestyle).

Males on Methotrexate are required to use barrier contraception for the duration of the trial and for 3 months after the completion of the trial/last treatment. Males on Methotrexate treatment should also refrain from donating sperm for the duration of the trial and for 3 months after completion of the trial/last treatment.

11 Assessment of Safety

11.1 Definitions

11.1.1 Adverse event (AE)

Any untoward medical occurrence in a patient or clinical trial participant administered a treatment and which does not necessarily have a causal relationship with this treatment.

An adverse event can therefore be any unfavourable and unintended sign (including an abnormal laboratory finding), symptom, or disease temporally associated with the use of a treatment, whether or not considered related to the treatment.

For the purpose of the trial, only AEs that are related to Crohn's disease (disease flares or surgery) or drug therapy for Crohn's disease (sufficiently severe to require a switch to an alternative treatment), or the associated biomarker sample collection will be recorded and assessed.

AEs related to drug therapy in particular should include the following, if taking the relevant medication:

Thiopurines (Azathiopurine or 6-Mercaptopurine)

- Pancreatitis (confirmed with either abdominal scan or amylase/lipase >2x upper limit of normal on local laboratory assay).
- Myelosuppression (WCC <2.0 10⁹/L or neutrophils <1.0 10⁹/L).
- Liver toxicity (transaminases >4x upper limit of normal on local laboratory assay).
- Lymphoma.
- Skin cancer.

Methotrexate

- Pneumonitis.
- Myelosuppression (WCC <2.0 10⁹/L or neutrophils <1.0 10⁹/L).
- Liver toxicity (transaminases >4x upper limit of normal).
- Pregnancy.

Anti-TNF (Infliximab or Adalimumab)

- Demyelination.
- Active tuberculosis.
- Sepsis (requiring hospitalisation).
- Malignancy.
- Anaphylaxis.

Please note: Recording of all adverse events must start from the point of Informed Consent regardless of whether a participant has yet received treatment.

11.1.2 Serious adverse event (SAE)

Any untoward medical occurrence that:

- Results in death.
- Is life-threatening.
- Requires hospitalisation or prolongation of existing inpatients' hospitalisation.
- Results in persistent or significant disability or incapacity.
- Results in a congenital anomaly or birth defect.
- Is an important medical event - Some medical events may jeopardise the participant or may require an intervention to prevent one of the above characteristics/ consequences. Such events should also be considered as 'serious'.

Life-threatening in the definition of a serious adverse event or serious adverse reaction refers to an event in which the participant was at risk of death at the time of event; it does not refer to an event which hypothetically might have caused death if it were more severe.

11.2 Evaluation of adverse events

The Sponsor expects that adverse events are recorded from the point of Informed Consent regardless of whether a patient has yet received a medicinal product. Individual adverse events should be evaluated by the Investigator. This includes the evaluation of its seriousness, causality and any relationship between drug therapy and/or concomitant therapy and the adverse event.

11.2.1 Assessment of seriousness

Seriousness is assessed against the criteria in section 11.1.2. This defines whether the event is an adverse event or a serious adverse event.

11.2.2 Clinical assessment of severity

Mild: The participant is aware of the event or symptom, but the event or symptom is easily tolerated.

Moderate: The participant experiences sufficient discomfort to interfere with or reduce his or her usual level of activity.

Severe: Significant impairment of functioning; the participant is unable to carry out usual activities and / or the participant's life is at risk from the event.

11.2.3 Recording of adverse events

Adverse events and adverse reactions should be recorded in the medical notes and the appropriate section of the CRF and/or AE log. Serious Adverse Events should be reported to the sponsor as detailed in section 11.3.

11.3 Reporting serious adverse events

Each Principal Investigator needs to record all adverse events and report serious adverse events to the Chief Investigator using the trial specific SAE form within 24 hours of their awareness of the event. The Chief Investigator is responsible for ensuring the assessment of all SAEs for expectedness and relatedness is completed and the onward notification of all SAEs to the Sponsor immediately but not more than 24 hours from first notification. The sponsor has to keep detailed records of all SAEs reported to them by the trial team.

The Chief Investigator is also responsible for prompt reporting of all serious adverse event findings to the competent authority if they could:

- Adversely affect the health of participants.
- Impact on the conduct of the trial.
- Alter the risk to benefit ratio of the trial.

The completed SAE form can be faxed or emailed. Details of where to report the SAE's can be found on the PROFILE SAE form and the front cover of the protocol.

11.4 Pregnancy Reporting

All pregnancies within the trial (for trial participants) should be reported to the Chief Investigator and the Sponsor using the relevant Pregnancy Reporting Form within 24 hours of notification. Pregnancy reporting should stop 3 months after the patient's last dose of trial medications.

Pregnancy is not considered an AE unless a negative or consequential outcome is recorded for the mother or child/foetus. If the outcome meets the serious criteria, this would be considered an SAE.

12 Toxicity – Emergency Procedures

In the event of toxicity reactions, standard medical practices will be employed, including emergency care and hospitalisation if needed. All medications in this trial are licensed for use in Crohn's disease and their uses are familiar to the physicians and staff at all participating centres.

13 Evaluation of Results (Definitions and response/evaluation of outcome measures)

The unblinded data will be presented to the Data Monitoring Committee, who will meet on a regular basis throughout the trial. The DMC will then prepare a report for the Trial Steering Committee who will provide overall supervision of the trial.

13.1 Response criteria

13.1.1 Glucocorticoid free remission

Glucocorticoid use will be measured following completion of the initial 8 week induction course of Prednisolone until week 48 from randomisation and will then be recorded at all trial time points. This specifically relates to a course of systemic glucocorticoid medication for treatment of active Crohn's disease.

13.1.2 Surgery free remission

All Crohn's disease related surgeries will be recorded from the date of randomisation and will be recorded at all trial time points.

13.1.3 Quality of life

Patient rated Quality of Life (QoL) measure (IDBQ & EQ-5D) will be recorded from the date of randomisation and at a variety of trial related time points.

14 Storage and Analysis of Samples

Stool samples are to be shipped to Addenbrooke's Hospital (Department of Medicine, University of Cambridge, Cambridge Biomedical Campus) for analysis of faecal Calprotectin and storage for future research into the microbiome. Samples can be stored at room temperature for transport and are stable for 7 days. On receipt samples will be stored at approximately -70C (or -80°C depending on the freezer) prior to processing and analysis.

Screening and weeks' 16, 32 and 48 serum samples (Pearl white-top plasma preparation tube) and screening blood sample (red-top EDTA preparation tube) are to be shipped to Addenbrooke's Hospital (Department of Medicine, University of Cambridge, Cambridge Biomedical Campus) for storage and subsequent analysis.

Samples are stable for 24-48 hours at room temperature. On receipt samples will be stored in a freezer with temperature controlled at approximately -70C (or -80°C depending on the freezer). Samples will be analysed for gene expression, proteins and metabolites including drug and antibody levels.

PAXgene blood RNA tubes are to be shipped to Addenbrooke's Hospital (Department of Medicine, University of Cambridge, Cambridge Biomedical Campus) for analysis. Samples are stable at room temperature for up to 3 days. On receipt samples will be logged and stored in a fridge (approximately 2-8°C) prior to processing. Samples stored in the fridge are stable for 5 days. Whole blood RNA will be extracted.

An aliquot of total RNA will be converted to cDNA for analysis, the remaining RNA and any residual cDNA will be stored in an approximately -70C (or -80°C depending on the freezer).

All blood and stool samples and materials derived from them will be stored anonymously, labelled with the unique trial number assigned to each participant. Trial samples and clinical outcomes data gathered as part of the trial will be linked via the unique trial number, to enable their use in future exploratory translational and scientific studies. These will include correlating clinical outcomes with microbial, metabolomic, proteomic, genetic and gene expression signatures and potentially the development of new biomarkers.

15 Statistics

15.1 Statistical methods

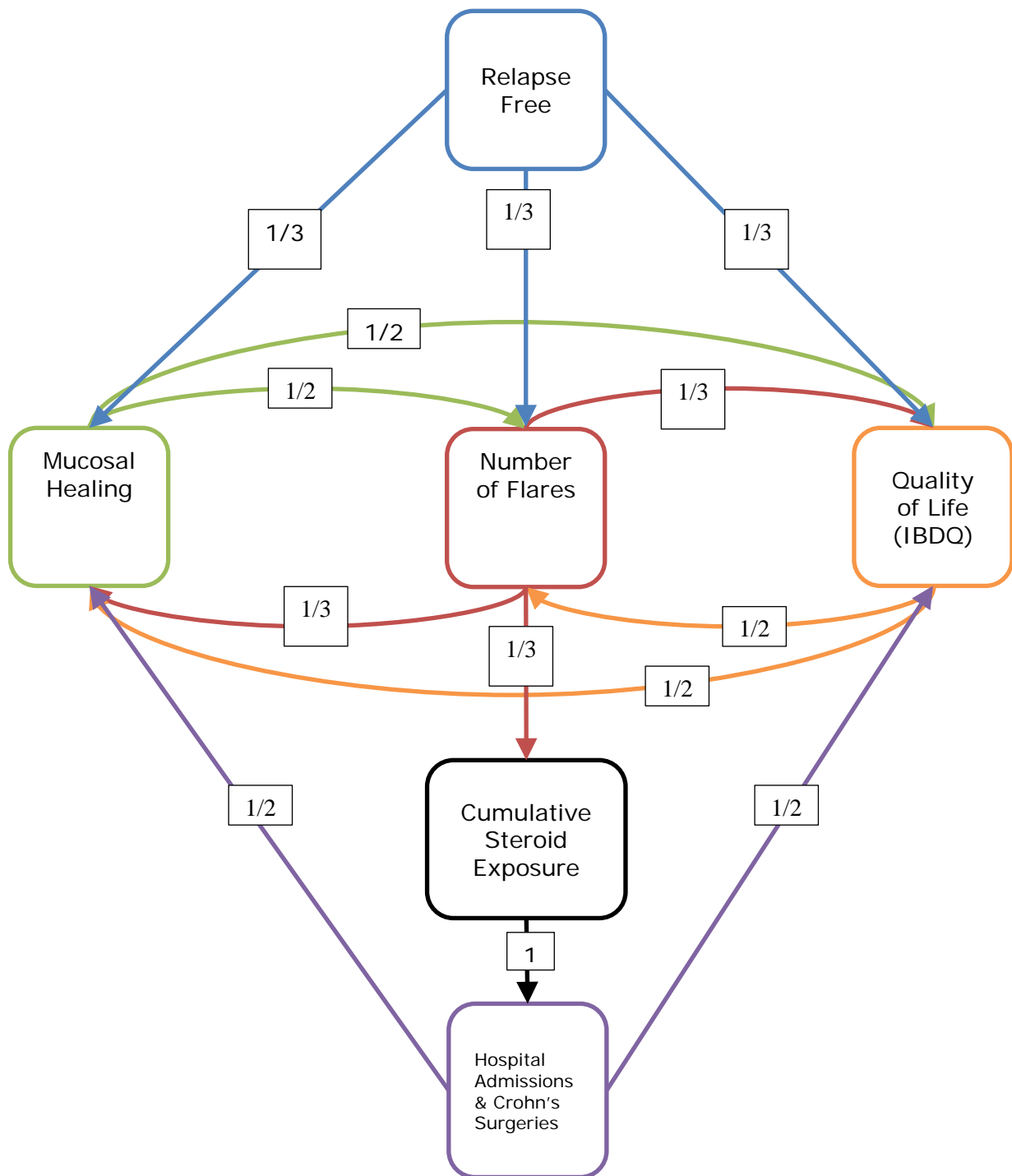
The primary outcome, relapse-free incidence, will be analysed with logistic regression using an additive link function to estimate the absolute relapse-free rate differences with main and interaction effects for treatment and biomarker, and adjusting for baseline variables:

- Smoking status.
- Disease location (Ileal, Colonic, Ileocolonic).
- Age.
- CRP.
- Calprotectin.
- Azathioprine / 6-Mercaptopurine vs Methotrexate.
- Course of glucocorticoids prior to trial enrolment (yes/no).

The primary comparison of interest is the additive interaction between treatment and biomarker: IBD^{hi} : ("Accelerated Step-Up" - "Top-Down") – IBD^{lo} : ("Accelerated Step-Up" - "Top-Down"). This effect will be estimated, with 95% confidence intervals and tested at a 2-sided 5% significance level. In general the key comparison of interest for all endpoints is the treatment-biomarker interaction, and not the main effects.

All comparisons (main effects, interactions, covariate adjustments) will be reported with estimates, 95% confidence intervals and p-values. However to formally control for multiple testing, we will perform a closed testing procedure over the primary and five secondary endpoints (see section 7.4.2) testing the biomarker-treatment interaction and restricting the family-wise type 1 error rate to an overall 5% significance level.

The methodology to combine together gate-keeping and Holm-Bonferroni methods in formal hypothesis testing will be used (Bretz et al. Stat Med 2009), with the diagram below defining how the significance levels will be transitioned assuming an initial configuration of 5% at the primary endpoint (relapse-free remission) and 0% on all other tests.



The diagram shows the flow of significance level spending in the sequential multiple testing procedure.

Mucosal healing is a binary endpoint and will be analysed in a similar fashion to the primary endpoint. All the remaining secondary endpoints are continuous variables and will be analysed using a linear regression framework adjusting for baseline covariates.

Quality of life is observed over repeated visits and will be analysed using a mixed effect repeat measure analysis with a clustered patient-level residual error with unstructured covariance over visits, fixed effects for visit, and all other covariates assumed to have a constant fixed effect over time.

Summary statistics will be provided broken down by treatment arm, pooled and stratified across biomarker subgroup. Continuous variables will be summarised by n, mean, median, SD, min, max; categorical or binary will be summarised by frequency (x/n) and percentage (%). Graphical counterparts will be provided: box and whisker plots for continuous variables, and stacked bar charts for categorical and binary variables.

15.2 Health Economics

A full health economic analysis will be performed; the detailed analysis will be described in the health economic analysis plan.

15.3 Interim analyses

No interim analyses will be performed. The DMC (unblinded) will review efficacy and safety data and will advise on the need for any additional analyses or alterations to the conduct or even continuation of the trial.

15.4 Number of participants to be enrolled

Remission rates were estimated using data pertaining to the clinical phenotype of IBD^{hi} and IBD^{lo} patients (see Appendix) and data from the literature regarding response to early anti-TNF α (including the original "Step Up-Top Down" study, D'Haens et al. 2008 Lancet 371:660-667, the SONIC trial Colombel et al. 2010 NEJM 362:1383-1395, and subgroup analyses of large anti-TNF α trials D'Haens. 2010 Nat Rev Gastroent Hepatol 7:86-92).

Estimated remission rates were: IBD^{hi}: "Accelerated Step-Up" 0.3, "Top-Down" 0.7; IBD^{lo}: "Accelerated Step-Up" 0.8, "Top-Down" 0.9. The prevalence of IBD^{hi}/ IBD^{lo} is 0.5/0.5 based on all of the cohorts in whom the classifier has been assessed. The primary comparison is powered as an interaction analysis, where the interaction refers to the difference between the relative benefits of "Top-Down" over "Accelerated Step-Up" in each subgroup. Based on the remission rates and subgroup prevalence rates above, an interaction of 0.3 can be detected with a power of 92% at a 2-sided 5% significance level with a total sample size of 333.

To allow for a ~17% drop out rate, 400 patients will be recruited across approximately 50 sites. This requires recruitment of 5 patients per site per year, which is a conservative estimate based on previous recruitment to Investigator-led UK studies. Recruitment will take place over 2 years.

15.5 Criteria for the premature termination of the trial

There are no defined criteria for the premature discontinuation of the trial. However the DMC and TSC will make recommendations on the discontinuation of the trial following review of the on-going patient safety and efficacy data presented at regular scheduled meetings.

15.6 Procedure to account for missing or spurious data

For the primary analysis missing data will be assumed to be missing at random.

15.7 Definition of the end of the trial

The end of trial will be the last patient's last trial visit.

16 Data handling and record keeping

16.1 CRF

All data will be transferred into a Case Report Form (CRF), which will be pseudo-anonymised. All trial data in the CRF must be extracted from and be consistent with the relevant source documents. The CRFs must be completed, dated and signed by the Investigator or designee in a timely manner. It remains the responsibility of the Investigator for the timing, completeness, legibility and accuracy of the CRF pages. The CRF will be accessible to trial coordinators, data managers, the Investigators, Clinical Trial Monitors, Auditors and Inspectors as required.

Completed originals of the CRFs should be posted to the trial coordination centre (Cambridge Clinical Trials Unit, Cambridge University Hospitals NHS Foundation Trust, Addenbrooke's Hospital, Coton House Level 6, Flat 61, Box 401, Hills Road, Cambridge, CB2 0QQ) within a reasonable time frame of the pages being completed.

The Investigator will retain a copy of each completed CRF page at site. The Investigator will also supply the trial coordination centre with any required, anonymised background information from the medical records as required.

All CRF pages must be clear and legible. Any errors should be crossed through with a single stroke so that the original entry can still be seen. Corrections should be inserted and the change dated and initialled by the Investigator or designee. If it is not clear why the change has been made, an explanation should be written next to the change. Typing correction fluid must not be used.

16.2 Source Data

To enable peer review, monitoring, audit and/or inspection, the Investigator must agree to keep records of all participants (sufficient information to link records e.g. CRFs, hospital records and samples), all original signed informed consent forms and copies of the CRF pages.

CRF pages are not considered to be source data.

Source data is considered to be the first recording of trial related information. Source data/documents can include but not exclusive to; patient medical records, patient trial notes, patient electronic medical records (including blood test results), signed informed consent forms, screening logs, patient rated QoL measures and sample logs. This list is not exhaustive.

Any data collection tools used for the purpose of aiding data collection are not considered to be source data.

16.3 Endoscopic Video and MRE Images

Colonoscopy video recordings and MRE images to be supplied anonymised and linked by trial number only.

16.4 Data Protection & Patient Confidentiality

All Investigators and trial site staff involved in this trial must comply with the requirements of the Data Protection Act 1998 and Trust Policy with regards to the collection, storage, processing and disclosure of personal information and will uphold the Act's core principles.

17 Data Monitoring Committee/Trial Steering Committee

The TSC will provide overall supervision with respect to the conduct of the trial. The independent chair of the TSC will be Geert D'Haens (Amsterdam Medical Centre, Amsterdam, Netherlands). Full details of the TSC membership and remit can be found in the TSC charter.

The ethical and safety aspects of the trial will be overseen by an independent DMC. The independent chair of the DMC will be Vipul Jairath (University Hospital, Ontario, Canada). DMC meetings will be timed so that reports can be fed into the TSC meetings. Full details of the DMC membership and remit can be found in the DMC Charter.

18 Ethical & Regulatory considerations

18.1 Consent

The Informed Consent form must be approved by the REC and must be in compliance with GCP, local regulatory requirements and legal requirements. The Investigator must ensure that each trial participant, or his/her legally acceptable representative, is fully informed about the nature and objectives of the trial and possible risks associated with their participation.

The Investigator will obtain written informed consent from each patient before any trial-specific activity is performed. The informed consent form used for this trial and any change made during the course of this trial, must be prospectively approved by the REC. The Investigator will retain the original of each patients signed informed consent form.

Should a participant require a verbal translation of the trial documentation by a locally approved interpreter/translator, it is the responsibility of the individual Investigator to use locally approved translators.

Any new information that becomes available, which might affect the participant's willingness to continue in the trial will be communicated to the participant as soon as possible.

18.2 Ethical committee review

Before the start of the trial or implementation of any amendment we will obtain approval of the trial protocol, protocol amendments, informed consent forms and other relevant documents e.g., advertisements and GP information letters if applicable from the REC. All correspondence with the REC will be retained in the Trial Master File/Investigator Site File.

Annual reports will be submitted to the REC in accordance with national requirements. It is the Chief Investigator's responsibility to produce the annual reports as required.

18.3 Regulatory Compliance

This is not an investigation of medicinal products.

18.4 Protocol Amendments

Protocol amendments must be reviewed and agreement received from the Sponsor for all proposed amendments prior to submission to the REC.

The only circumstance in which an amendment may be initiated prior to REC approval is where the change is necessary to eliminate apparent, immediate risks to the patients (Urgent Safety Measures). In this case, accrual of new patients will be halted until the REC approval has been obtained.

18.5 Peer Review

The trial proposal has been peer-reviewed and is supported by the Wellcome Trust as part of the translational funding award process.

The trial protocol was peer reviewed by the British Society of Gastroenterology IBD Clinical Research Group (BSG IBD CRG).

18.6 Declaration of Helsinki and Good Clinical Practice

The trial will be performed in accordance with the spirit and the letter of the declaration of Helsinki, the conditions and principles of Good Clinical Practice, the protocol and applicable local regulatory requirements and laws.

19 Sponsorship, Financial and Insurance

The trial is sponsored by Cambridge University Hospitals NHS Foundation Trust and the University of Cambridge. The trial is funded by the Wellcome trust.

Cambridge University Hospitals NHS Foundation Trust, as a member of the NHS Clinical Negligence Scheme for Trusts, will accept full financial liability for harm caused to participants in the clinical trial caused through the negligence of its employees and honorary contract holders. There are no specific arrangements for compensation should a participant be harmed through participation in the trial, but no-one has acted negligently.

The trial Sponsors will arrange insurance for negligent harm caused as a result of protocol design and for non-negligent harm arising through participation in the clinical trial.

Infliximab for trial participants will be supplied to hospitals via a trial specific ordering form. If participants move to Adalimumab, the cost of this can be reimbursed by the sponsor on receipt of quarterly invoices.

Travel, parking and any other reasonable costs to attend trial visits (up to £240 total/£40 per visit for the duration for the trial) can be reimbursed for participants. Participating trusts can request reimbursement on a quarterly basis from the trial sponsor.

20 Monitoring, Audit & Inspection

Should a monitoring visit or audit be requested, the Investigator must make the trial documentation and source data available to the Sponsor's representative. All patient data must be handled and treated confidentially.

The Sponsor's monitoring frequency will be determined by an initial risk assessment performed prior to the start of the trial. A monitoring plan will be generated detailing the frequency and scope of the monitoring for the trial. All participating sites will be subject to routine trial specific on-site monitoring.

21 Protocol Compliance and Breaches of GCP

Prospective, planned deviations or waivers to the protocol are not allowed under the UK and European regulations on Clinical Trials and must not be used.

For example, it is not acceptable to enrol a participant if they do not meet one or more eligibility criteria or restrictions specified in the trial protocol. In the event that eligibility criteria need to be changed/amended then they MUST first be approved by REC via a substantial protocol amendment before they can be implemented.

Protocol deviations, non-compliances, or breaches will be documented on the relevant forms and reported to the Chief Investigator and Sponsor immediately.

Deviations from the protocol which are found to recur constantly will be addressed with immediate action.

Any potential/suspected serious breaches of GCP will be reported immediately to the Sponsor without any delay.

22 Publications policy

Ownership of the data arising from this trial resides with the trial team (comprising the Chief Investigator, Co-Investigators, Chief Technical Officers). On completion of the trial the data will be analysed and tabulated and a Final Trial Report prepared.

Participating Investigators do not have rights to publish any trial data.

This is a Wellcome Trust funded trial (translational funding grant) and the Wellcome Trust publishing guidelines will be followed.

Following completion of the Final Trial Report and publication of results, participants in the trial can request trial results from their Principal Investigator and they can be provided with a link of publicly available manuscripts.

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24 Appendices

24.1 Appendix 1 - Trial Management / Responsibilities

24.1.1 Patient registration/ Randomisation procedure

Patients will be randomised using a stratified block randomisation technique via a web-based system.

24.1.2 CRF Completion & Data management

All CRFs should be completed in a timely manner. Data management at the Trial Coordinating Centre will be undertaken by the trial coordinating team. The local Principal Investigators will be responsible for overseeing the collection of accurate data at their participating site. The completed CRFs will be signed by either the Principal Investigator or a suitably qualified and delegated member of their trial team. Data management will entail the checking of the CRFs and ensuring that data queries are completed in a timely manner in accordance with the data management plan.

24.1.3 Preparation & submission of amendments

Amendments to the trial will be prepared and submitted to the appropriate authorities, by a member of the Trial Coordinating team. Subsequent approvals will then be disseminated to all sites, prior to implementation.

24.1.4 Preparation and submission of Annual Safety Report/Annual Progress Reports

A member of the Trial Coordinating team will prepare the ASR and APR reports prior to submission.

24.1.5 Trial Monitoring

The frequency, scope and method of monitoring will be determined by the Sponsor's trial level risk assessment. All sites will be monitored in accordance with the monitoring plan.

24.1.6 Data protection/ confidentiality

All investigators and trial site staff involved in this trial must comply with the requirements of the Data Protection Act 1998 and Trust policy with regards to collection, storage, processing and disclosure of personal information and will uphold the Act's core principles.

24.1.7 Trial documentation & archiving

All trial documentation will be retained in a secure location during the conduct of the trial and following end of trial, archived in accordance with the Sponsors SOPs. Each site will be responsible for archiving their Investigator Site File and associated trial documentation.

24.2 Appendix 2 – Authorisation of Participating Sites

24.2.1 Required Documentation

Prior to initiating a participating site the following documentation is required;

- Principal Investigator and other key trial team staff CV (signed and dated) and GCP certificate
- Competent Authority approval (HRA)
- Local R & D compliance and capacity approval
- Participating Site Agreement executed, including pharmacy participating site agreement
- Patient Information sheets and consent forms on local headed paper
- Protocol signed and dated by Principal Investigator
- Delegation of Authority Log
- Confirmation of randomisation system training

24.2.2 Procedure for initiating/opening a new site

When all the regulatory paperwork is in place, prior to site opening, an initiation meeting will take place, either face to face or via a teleconference. This will be led by a member of the Trial Coordinating team with as many of the local team present as is practicable. This initiation meeting constitutes training for the trial and it is therefore imperative that all members of the trial team who will be involved in the trial are represented at the meeting. A log of attendees will be completed during the meeting. The presentation slides will be provided to the site in advance of the meeting. A trial initiation form will be completed for each site initiation meeting. Copies of all initiation documentation must be retained in the Investigator Site File.

The sponsor's regulatory green light procedure will be followed. Following the green light, the initial supply of IMP will be ordered for shipment to the site on the authorisation of the coordinating centre coordinator. Following confirmation of receipt of the IMP at site, the site will be opened for recruitment and the randomisation system opened to that site.

24.2.3 Principal Investigator Responsibilities

The Principal Investigator has overall responsibility for the conduct of the trial at the participating site.

In particular, the Principal Investigator has responsibilities, which include (but are not limited to):

- Ensuring the appropriate approvals are sought and obtained.
- Continuing oversight of the trial.
- Ensuring the trial is conducted according to the protocol.
- Ensuring consent is obtained in accordance with the protocol and national requirements.
- Ensuring that the ISF is accurately maintained.
- Delegation of activities to appropriately trained staff (this must be documented on the delegation of authority log).

- Providing protocol or specialised training to new members of the trial team and ensuring that if tasks are delegated, the member of staff is appropriately trained and qualified.
- Appropriate attendance at the initiation meeting.
- Ensuring appropriate attendance at the TSC/IDMC meetings if required and ensuring appropriate safety information is made available to the coordinating centre team in advance of the meetings.
- Dissemination of important safety or trial related information to all stakeholders at the participating site.
- Safety reporting within the timelines and assessment of causality and expectedness of all SAEs.

24.3 Safety Reporting Flow Chart

