ISRCTN10920454 https://doi.org/10.1186/ISRCTN10920454

Measuring biomarkers using aptamers

Submission date	Recruitment status	[ ] Prospectively registered
26/02/2024	Recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
17/05/2024	Ongoing	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
17/05/2024	Nutritional, Metabolic, Endocrine	[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Most diseases are diagnosed and/or monitored by measuring specific substances (called biomarkers) in the blood or other bodily fluids. The way these substances are currently measured is slow, expensive and requires a large amount of blood or other fluid from the body. Therefore, the number of blood tests that can be conducted is limited and may not be enough to diagnose a condition as quickly, assess a patient's condition in detail or monitor a condition very closely.

Working with bioengineers and chemists, the study team have developed a new method of measuring markers in body fluids that is more cost-effective, gives instant results and only requires very small amounts of fluid samples such as blood or other body fluids. This new method uses a technology called aptamers, which can be linked to sensors that can be attached to the skin, to measure biomarker levels. This study will compare the standard method of measuring biomarkers (i.e. by sending blood samples to the clinical laboratory) with the new aptamer-based method (using blood, urine, saliva and/or fluid in the skin called interstitial fluid). If this new aptamer-based method is successful, it will allow doctors to diagnose conditions earlier and monitor patients more closely, using equipment that is small enough for patients to wear while they go about their daily activities.

Who can participate?
Participants aged ≥18 years old who EITHER have no current medical condition OR a current medical condition that can be diagnosed or monitored using biomarkers

What does the study involve?
If they are suitable to take part in the study, their GP will be informed that they are taking part in this study (with their permission). During each study visit, participants will be monitored by study doctors. All of the people who take part in the study will be asked to attend up to 6 study visits. There will be a gap of at least 1 week between the first study visit (Visit 1) and the rest of the study visits (Visits 2-6). Visits 2-6 will take place over 1 month. Each study visit is explained below:

Throughout all study visits, a small plastic tube referred to as a cannula will be inserted into the participant's arm to facilitate blood sample collection. Additionally, if necessary for specific biomarkers, blood may be obtained through a fingerprick test. The volume of blood extracted

during each visit will not exceed 150ml, which is less than half of a standard can of Coke. Over one month, the maximum blood drawn will be capped at 450ml, akin to the quantity taken during a single blood donation session. This allocation will be adjusted as needed to ensure compliance with the monthly limit.

During Visit 1, conducted at the Clinical Research Unit within the hospital, participants will undergo a visit lasting up to 12 hours. Apart from blood sampling, interstitial fluid will be collected using minute needles. Samples of urine, sweat, and saliva may also be gathered if required for specific biomarkers. After the visit, both the cannula and interstitial fluid needles will be removed before the participant's departure.

Visit 2 mirrors Visit 1, with the additional attachment of a sensor device akin to a glucose monitor to track biomarkers. Participants who agree to wear the sensor device at home will be instructed to do so for up to one month following Visit 2.

Visit 3 occurs while participants continue wearing the sensor device to verify its functionality. The procedures during this visit replicate those of Visit 1, except the participant wears the sensor device throughout. Similarly, if participants opt to continue wearing the sensor device at home, it will remain attached after Visit 3, or be replaced if necessary.

Visit 4, Visit 5, and Visit 6 maintain the same protocol as Visit 3, with a focus on confirming the sensor device's continued effectiveness. Participants who agree to continue wearing the sensor device at home will do so following each of these visits.

Visit 6 marks the final study visit, during which the sensor device and cannula are both removed before the participant leaves. If further evaluation of the sensor device is deemed necessary before home use, either Visit 1 or Visit 2 will be repeated, with the sensor device removed before departure. However, participants will not be required to attend more than a total of six study visits.

What are the possible benefits and risks of participating?
The information obtained from this study may help to develop better methods of measuring markers of medical conditions, which will help patients to be diagnosed quicker and help their conditions to be monitored more thoroughly. As the technology is still being developed and tested, it is not anticipated that participants will have any direct benefits as a result of taking part in the research. New information about a health condition will be passed on to the participant's GP (with their permission).

This study involves blood tests and the siting of a cannula in a vein in the arm, as well as siting a sensor device to collect interstitial fluid. This can cause some minor discomfort and bruising. However, taking samples will only be carried out by experienced personnel in an attempt to limit this as much as possible.

Where is the study run from?
Imperial College London

When is the study starting and how long is it expected to run for?
November 2021 to November 2027

Who is funding the study?
The NIHR Imperial Biomedical Research Centre

Who is the main contact?
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Contact information

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Public, Scientific

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Integrated Research Application System (IRAS)
290012

Protocol serial number
21HH6658, IRAS 290012, CPMS 51639

Study information

Scientific Title
Measuring biomarkers using aptamers

Study objectives
Aptamers can be used to reliably measure biomarkers in different biological fluids.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 28/03/2022, West London and GTAC Research Ethics Committee (Room 4W/12, 4th Floor Charing Cross Hospital, Fulham Palace Road, London, W6 8RF, United Kingdom; +44 (0)207 104 8098, (0)207 104 8165, (0)207 104 8184; westlondon.rec@hra.nhs.uk), ref: 22/LO/0021

Study design
Prospective single-centre study

Primary study design
Observational

Study type(s)
Other

Health condition(s) or problem(s) studied
Different physiological states (e.g. phases of menstrual cycle e.g. follicular, pre-ovulatory, luteal phase) and endocrine conditions (e.g. Cushing's syndrome, Addison's disease, Acromegaly, Hypothalamic Amenorrhoea, Polycystic Ovary Syndrome).

Interventions
This prospective single-centre observational study aims to investigate aptamer-based biomarker measurement and assess the ability of aptamer-based sensors to detect and measure biomarkers.

Study participants will attend up to 6 study visits.
Visit 1: Participants will come to the Clinical Research Unit for this visit. A microneedle /microdialysis system containing the aptamer will be applied under the skin (i.e. subcutaneously) and an intravenous cannula will also be inserted. Samples for biomarker measurement will be taken intermittently using the aptamer device and via the intravenous cannula for up to 720 minutes. Urine samples, sweat and saliva samples may also be collected for biomarker measurement. The microdialysis/microneedle system and the intravenous cannula will be removed at the end of the study visit.

Visits 2-6: Once validated, a portable aptamer device will be applied for up to one month. This is to enable measurement of biomarker levels for prolonged periods whilst undergoing daily activities and to be able to account for different physiological states (e.g. phase of menstrual

cycle). During this period, ‘Study Visit 1’ will be repeated to periodically validate the aptamer measured levels on no more than five additional occasions (i.e. Study Visits 2-6). If the sensor device requires additional assessment before participants can wear it at home, then subsequent study visits will be similar to ‘Study Visit 1’ (i.e. interstitial fluid will be collected but the sensor device will be removed at the end of the study visit before the participant goes home). A maximum of 6 study visits will be conducted in total over the study period.

Intervention Type
Device

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Portable aptamer device

Primary outcome(s)
1. Biomarker levels in biological fluid(s) measured using the aptamer device via intermittent sampling compared with biomarkers measured in blood using standard laboratory assay methods, both for up to 720 minutes during Visit 1 and up to 5 other study visits in healthy volunteers and patients with a medical condition that can be diagnosed or monitored using biomarkers.
2. Production of normative ranges for biomarkers measured using the novel aptamer device (at different times of the day, e.g. 0800-1000, 1200 and 1700) in healthy volunteers in different physiological states (e.g. the follicular, pre-ovulatory and luteal phases of the menstrual cycle) and people with endocrine conditions (e.g. Cushing’s syndrome, Addison’s disease, Acromegaly, hypothalamic amenorrhoea, polycystic ovary syndrome).

Key secondary outcome(s))
There are no secondary outcome measures

Completion date
30/11/2027

Eligibility

Key inclusion criteria
1. Aged ≥18 years old
2. Either no current medical condition OR a current medical condition that can be diagnosed or monitored using biomarkers

Participant type(s)
Healthy volunteer, Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Sex
All

Key exclusion criteria
1. History of medical, psychological or other conditions, or use of any medications, including over-the-counter products, which, in the opinion of the investigators, would either interfere with the study results to make them no longer useful or could potentially result in harm to the participant.
2. History of blood donation within the past 3 months, or the intention to do so within 3 months of completing the study.

Date of first enrolment
09/05/2022

Date of final enrolment
01/11/2027

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
NIHR Imperial Clinical Research Facility
Hammersmith Hospital
Du Cane Rd
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W12 0HS

Sponsor information

Organisation
Imperial College London

ROR
https://ror.org/041kmwe10

Funder(s)

Funder type
Government

Funder Name
NIHR Imperial Biomedical Research Centre

Alternative Name(s)
NIHR Imperial BRC, Imperial Biomedical Research Centre, BRC

Funding Body Type
Private sector organisation

Funding Body Subtype
Research institutes and centers

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are not expected to be made available due to the fact that they may contact some potentially identifiable information.

IPD sharing plan summary
Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	version 3.0	22/03/2022	22/03/2024	No	Yes