European Translational Information and Knowledge Management Services

eTRIKS Deliverable report

Grant agreement no. 115446

Deliverable 3.2

Initial standards report – document recommending standards available for use in eTRIKS v1

Due date of deliverable: Month 25
Actual submission date: Month 31

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted to a group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including Commission Services)	

DELIVERABLE INFORMATION

Project	
Project acronym:	eTRIKS
Project full title:	European Translational Information and Knowledge Management Services
Grant agreement no.:	**115446**
Document	
Deliverable number:	3.2
Deliverable title:	Initial standards report – document recommending standards available for use in eTRIKS v1
Deliverable version:	1
Due date of deliverable:	Month 25
Actual submission date:	Month 31
Leader:	
Editors:	
Authors:	Fabien Richard, Robin Munro, Paul Houston
Reviewers:	Nathalie Jullian, Chris Marshall
Participating beneficiaries:	
Work Package no.:	3
Work Package title:	Standards Research and Coordination
Work Package leader:	Michael Braxenthaler, Paul Houston
Work Package participants:	
Estimated person-months for deliverable:	1 pm
Nature:	PU
Version:	1
Draft/Final:	Final
No of pages (including cover):	17
Keywords:	Standards, Data

Purpose

As set out in the Description of Work, WP3 aims to identify, develop and adopt data standards and controlled terminologies for translational researchers using the eTRIKS Platform and in the wider community. The consistent application of standards to a scientific discipline is a prerequisite for meaningful exchange of information and combining of data from multiple sources.

In this document we provide an overview of our analysis of the standards landscape as it existed within the original set of supported projects at the time the eTRIKS project commenced. Recommendations are proposed that can be put in place to begin to address the deep-seated issues we uncovered

Intended audience

The readership of this document is assumed to be familiar with eTRIKS and its overall aims, including being aware of the work completed to date with respect to the tranSMART for eTRIKS software.

Contents

Recommending standards for eTRIKS, deliverable 3.2 and much further beyond

At the original conception of the eTRIKS project it was anticipated that a list of standards would be a good starting point and this deliverable does highlight some of the leading terminologies and standards in use now and at the start of the project as used by the participating eTRIKS projects. Deliverable 3.4 goes on to give a much more comprehensive list.

However, the early findings of work package 3 have pointed towards the fact that the overwhelming choice of standards available (total 584 standards https://www.biosharing.org/standards/), particularly in the omics world means that only by offering a database or archive system of electronically implementable, semanitically interoperable, flexbile standards templates, will data ever be comparable, consistent and of high enough quality to effectively further advance or support effective research.

In this deliverable we will also outline some of the essential directions that the project must take in order to achieve the goal of creating data sets that are interoperable and the agreed mechanic to do that is essentially to deliver standards electronically and from the beginning of a project's inception at study design and protocol all the way through to the analysis of results. Lists of standards alone will not achieve the central goals of eTRIKS' Work Package 3 to drive true translational research advancements through sharing of comprehendible translational knowledge There are many parallel efforts that work package 3 is engaged in right now including CDISC SHARE, Roche's MDR work, Stanfords CEDAR project, Biosharing portal, and ISA Tab templates. Leveraging elements and experience from those leading projects will ensure that the data standards compliant systems and methodologies implemented by eTRIKS will meet the translational research goals of the eTRIKS project. It will be only through rigorous methodology and integrated systems and standards that eTRIKS will become a platform for high quality leading edge research and that is where the focus and effort of work package 3 will be for the remaining length of the project.

Review of supported projects data types and standards used

A review of standards organisations and their appropriate standards to use within TranSMART was carried out as part of the project set-up. The following standards were identified within the organisations and projects forming the initial eTRIKS landscape and this has been extended for the 3.2 deliverable. The 3.4 deliverable goes on to list a more comprehensive list of standards and terminologies.

The list below comprises of terminologies and standards that meet the 'fitness for purpose' criteria that work package 3 have further defined in deliverable 3.4 Section 2.2.

Name	Description	Context	Project Name
CAS	Medications, registry numbers	Chemistry	JnJ-tranSMART
dbSNP/RefSNP	SNP identifiers and classes	Variome	BTCure, JnJ-tranSMART
hg19	Human Genome reference build version	Genome	OncoTrack
HGNC GeneName	The HUGO Gene Nomenclature Committee assigned unique gene symbols	Genome	U-BIOPRED (transcript, proteomics), OncoTrack, JnJ-tranSMART
ICD-10	The WHO International Classification of Diseases	Disease	JnJ-tranSMART
LIPID MAPS	Lipid Classification System	Chemistry	U-BIOPRED
MAGE-ML and MINiML	MicroArray and Gene Expression XML formats	Microarray	OncoTrack (via XSL)
MedDRA	Medical Dictionary for Regulatory Activities - is a medical terminology used to classify adverse event information	Clinical	JnJ-tranSMART
MeSH Diseases	Medical Subject Headings (MeSH) is a comprehensive controlled vocabulary, in this case for Diseases	Disease	JnJ-tranSMART
Pubchem	Database of chemical molecules, used for Lipids in this case	Chemistry	U-BIOPRED, JnJ-tranSMART
Therapeutic Area Standards	Therapeutic Area Standards that extend the SDTM data set	Disease Specific	U-BIOPRED, OncoTrack (if

	standard. (e.g. Alzheimer's disease, Parkinson's disease, Pain/Analgesia, and Cardiovascular Disease)		required)
SDTM	Study Data Tabulation Model (CDISC)	Clinical	BTCure, U-BIOPRED, OncoTrack, JnJ-tranSMART
CDASH	standard describes the basic recommended data collection fields for 18 domains; including demographics, adverse events, and other common domains that are common to most therapeutic areas and phases of clinical research	Clinial	Not Known
CDISC LAB	CDISC data tabulation standard for laboratory data	pre-clinical	No Known

Initial Review of Standards within Supported Projects

At its inception eTRIKS undertook the support of 4 existing translational research projects covering a range of disease areas

UbioPRED	IMI/EFPIA funded project investigating asthma
AbiRisk	IMI/EFPIA funded project investigating anti-drug antibodies
OncoTrack	IMI/EFPIA funded project investigating oncology biomarkers
RA-MAP	MRC/ABPI funded project investigating rheumatoid arthritis

It was found that within the projects, with the exception of CDISC standards for clinical data, there was little attempt to use standardisation for translational research data. Each project typically had developed or was developing an internal set of standards for translational data, but these were based on the specific requirements of the individual participants of the project and did not constitute sets of standards that could be deployed beyond the specific project.

Because of the local nature of the standards there was significant resistance to the suggestion that these standards could be more widely shared.

This observation was reported to the inaugural eTRIKS Standards Advisory Board.

Review and feedback on presentation of Standards Landscape to eTRIKS Standards Advisory Board

Ann Martin (IMI) and the eTRIKS standards work package sought advice and recommendations from the eTRIKS standards advisory board concerning the current data standards landscape and adoption of data standards. The advisory board represents some of the leading figures in the development of medical research data standards arena.

The bullets below represent the input and recommendations of the advisory board and highlights some of the challenges that work package 3 will seek to overcome with their remaining deliverables and strategy as outlined above.

Recommendations made by the Standards Advisory Board

- ☐ Coordinate a community of standards experts that are allowed to speak freely. Develop a standards infrastructure, from bio-banking through to sustainability.
- ☐ Perhaps each IMI project should employ a standards expert as their data manager
- ☐ Use IDs for ontology's and provenance. Statistics on what ontology's are currently being adopted would be very useful.
- ☐ U-BIOPRED to use ISA tool.
- ☐ Think big, think beyond eTRIKS. Provide the users a value to the use of data standards. Use cases in the context can be very useful. Convince people as to why we are doing this and the value of provenance. Also, inform people of the consequences of failing to adopt a universal set of standards.
- ☐ To adopt an eye level coordination approach for general standards,A pilot study/starter pack set. A narrow list of standards and an SOP. Perhaps adopt a 5 domain approach: Disease, treatment, Patient, Assay, Sample.
- ☐ The low hanging fruit, provide a few data sets and go through the process.

1. Minimum Information Guidelines (MIG) or similar.
2. Identify fields, first a core set of ontology's
3. Align ontology's
4. Define criteria for which ontology's are most used.
5. Implement tools

6. Harmonize data sets
7. Load datasets into tranSMART

- ☐ Subsequent to the eye level coordination use a larger survey, a data driven approach to produce a model for tranSMART.
- ☐ Draw up an education and training scheme
- ☐ To identify a success story eg the PKD foundation or Dr Ron Perrone success story to present as a user case
- ☐ To combine two similar datasets, eg Gate foundation and Predict TB
- ☐ Launch aneTRIKS call for using standards.
- ☐ Apply a metrics test to determine levels of use of each ontology/standard
- ☐ A standards community drive, think big and go beyond your traditional communities. Jan-Eric Litton

Additional suggestions/comments made

- ☐ The tracking/monitoring of standards use.
- ☐ To make data models public.
- ☐ Metadata used by projects should be made openly available.
- ☐ Should always include biobanking as part of the data modeling strategy.
- ☐ Protocols and SOPs and data models are essential to allow for good data storage, integration and provenance.
- ☐ Try and incentivize sharing of data, we could use citations, aligning data through authors, accreditation through publishing their work.
- ☐ Highlight the value and benefit to sharing data to all projects, EFPIA and others.
- ☐ Be careful not to recommend two standards for one domain.
- ☐ We must apply metrics for the standards community in some quasi anonymous way so that we can reduce the possibility of bias in the recommendation of standards.
- ☐ eTRIKS could endorse a set of standards, as a way of trying to homogenize the community, to do this we could employ legal entities within the community.
- ☐ Could we align standards efforts between ELIXIR/MRI/IMI
- ☐ We don't need to cover everything, a pragmatic approach to standards can be employed in parallel with a more considered strategy form long term adoption.
- ☐ Standards stamps need to be formalized in the context of eTRIKS
- ☐ Perhaps a structured questionnaire can be given to account managers to forward to project data managers. The questions must be considered and relatively few. Perhaps this could also be sent out to the wider community. We could supply a refined eTRIKS standards use list, and ask if the projects use anything on the list.
- ☐ The EFPIA survey maybe a little challenging, due to potential resistance.

- ☐ The eTRIKS standards approach should be inclusive and in parallel a more specific approach can be adopted, ie the use of the minimal information guidelines.
- ☐ BIOBANKS: A minimal requirements list for biobanks have been proven to work.

Issues

- ☐ Timeline alignment for therapeutic disease.
- ☐ Aligning multi-stakeholders and the uptake of renewed and improved standards. Long term projects already committed to using older standards can come across issues, ie versioning of standards.
- ☐ All pharma have their own bioportal to which we may not get access.
- ☐ There are currently no guidelines as to what data should go into tranSMART.
- ☐ There is generally a low understanding of data standards and standards uptake.
- ☐ Languages are a barrier to good integration of data.
- ☐ Standards maintenance, who does this?
- ☐ Those using unique standards may be hesitant to submit their standards due to fear of the critique process.
- ☐ There is already certain biased alignment within the standards community that prevents full integration of standards.

Actions

- ☐ To look at the methods to encourage partners of IMI projects to share data.
- ☐ Discuss with the TraIT community the implementation of the ISA tool and Susanna Sansone approach.
- ☐ Standards success story blog.
- ☐ Become familiar with Susanna Sansone training plan.
- ☐ Show to TraIT currently used ontologies.
- ☐ Propose new deliverables to the WP3 team and draw up a clear document describing intent for submission for a new amendment. WP3.

Appendix

Data types in use, or proposed in supported projects May 2013

As part of the outreach to engage translational research projects at the commencement of the eTRIKS project, eTRIKS undertook a review of the data types and experimental platforms that the projects were using or planned to use.

Project Name	Study			Comments
	What data type?	What technology is used?	What is the vendor name of platform?	What is the name of platform or assays?
ABIRISK	Cell	?		Complete blood count (CBC)
RA-MAP	Cell	Flow cytometry/immunophenotyping	??	cell types, cell counts
RA-MAP	Cell	Flow cytometry/immunophenotyping	??	cell types, cell percentage
U-BIOPRED	Cell	Flow cytometry?		Cell counts (leukocytes, bronchial epithelial, alveolar macrophage): FACS? Other techno?
U-BIOPRED	Cell?	?		Haematology tests: which ones?
ABIRISK	Cell?	Flow cytometry		cell count?
ABIRISK	Cell?	Flow cytometry-CSFE staining		?
U-BIOPRED	Clinical	?		expiratory reserve volume (Functional Expiratory Reserve)
U-BIOPRED	Clinical	Bronchoscopy		
U-BIOPRED	Clinical	NA		Abdominal Girth (cm)
U-BIOPRED	Clinical	NA		ACQ completed
RA-MAP	Clinical	NA		ACR/Eular remission criterion
ABIRISK	Clinical	NA		adverse events: Which ones?
U-BIOPRED	Clinical	NA		adverse events: Which ones?
RA-MAP	Clinical	NA		adverse events: Which ones?
Oncotrack	Clinical	NA		age
ABIRISK	Clinical	NA		age
U-BIOPRED	Clinical	NA		Asthma control questionnaire
U-BIOPRED	Clinical	NA		Asthma quality of life questionnaire
U-BIOPRED	Clinical	NA		Atopy?? exposures and triggers ?
U-BIOPRED	Clinical	NA		blood pressures
U-BIOPRED	Clinical	NA		Bronchial breath sounds
RA-MAP	Clinical	NA		Clinical Disease Activity Index (CDAI)
U-BIOPRED	Clinical	NA		Current asthma medication use at Screening

U-BIOPRED	Clinical	NA		demographics: What variables?
U-BIOPRED	Clinical	NA		Diagnosis of asthma what parameters? What tests?
U-BIOPRED	Clinical	NA		Diminished breath sounds
U-BIOPRED	Clinical	NA		Dullness of percussion
U-BIOPRED	Clinical	NA		Environmental/Residential Factors
U-BIOPRED	Clinical	NA		Epworth sleepiness scale
ABIRISK	Clinical	NA		ethnicity
U-BIOPRED	Clinical	NA		Exacerbation History? What variables?
ABIRISK	Clinical	NA		Exclusion criteria: Which ones? What tests?
U-BIOPRED	Clinical	NA		Exclusion criteria: Which ones? What tests?
RA-MAP	Clinical	NA		exclusion criteria: which ones? Which test?
RA-MAP	Clinical	NA		Extended (66/68) Joint Count
RA-MAP	Clinical	NA		FACIT-F
U-BIOPRED	Clinical	NA		Family history
U-BIOPRED	Clinical	NA		Food allergies
U-BIOPRED	Clinical	NA		Forced oscillation technique (FOT)
U-BIOPRED	Clinical	NA		Gender
ABIRISK	Clinical	NA		Harvey Bradshow index
RA-MAP	Clinical	NA		Health Assessment Questionnaire (HAQ)
U-BIOPRED	Clinical	NA		Health outcomes???
U-BIOPRED	Clinical	NA		Heart rate (bpm)
U-BIOPRED	Clinical	NA		Height (cm)
U-BIOPRED	Clinical	NA		Hospital Anxiety and Depression Scale (HADS) is commonly used by doctors to determine the levels of anxiety and depression that a patient is experiencing.
ABIRISK	Clinical	NA		Inclusion criteria: Which ones? What tests?
U-BIOPRED	Clinical	NA		Inclusion criteria: Which ones? What tests?
RA-MAP	Clinical	NA		inclusion criteria: which ones? Which test?
RA-MAP	Clinical	NA		IPQ-R-RA
RA-MAP	Clinical	NA		Larsen's score on x-ray
U-BIOPRED	Clinical	NA		Lung Function: which ones? What test?
RA-MAP	Clinical	NA		MAPLe-RA
ABIRISK	Clinical	NA		Mayo score
ABIRISK	Clinical	NA		Medical/Surgical history
U-BIOPRED	Clinical	NA		Medical/Surgical history
U-BIOPRED	Clinical	NA		Medication Adherence Report (MARS)?
ABIRISK	Clinical	NA		Medication history
RA-MAP	Clinical	NA		Medications
ABIRISK	Clinical	NA		Medications
U-BIOPRED	Clinical	NA		Medications
U-BIOPRED	Clinical	NA		Methacholine challenge test: lung vol?
U-BIOPRED	Clinical	NA		nicotine breath test: lung volume?
RA-MAP	Clinical	NA		Pain scale: Visual Analog Scale (VAS)
U-BIOPRED	Clinical	NA		Patient assessment: which ones?
RA-MAP	Clinical	NA		Patient assessment: which ones?
RA-MAP	Clinical	NA		Physical examination?? What parameters?
ABIRISK	Clinical	NA		Physical examination?? What parameters?
U-BIOPRED	Clinical	NA		Physical examination?? What parameters?

U-BIOPRED	Clinical	NA		Pregnancy status
RA-MAP	Clinical	NA		RA progression monitoring. DAS28 score
ABIRISK	Clinical	NA		Race
U-BIOPRED	Clinical	NA		Rales
ABIRISK	Clinical	NA		Replase assessment
U-BIOPRED	Clinical	NA		Respiratory history: what parameters?
U-BIOPRED	Clinical	NA		Respiratory rate (No. of breaths/min)
U-BIOPRED	Clinical	NA		Reversibility test: lung volume?time of recover?
Oncotrack	Clinical	NA		sex
ABIRISK	Clinical	NA		sex
RA-MAP	Clinical	NA		SF-36. The Short Form (36) Health Survey is a patient-reported survey of patient health. The SF-36 is a measure of health status.
RA-MAP	Clinical	NA		Simplified Disease Activity Index (SDAI)
U-BIOPRED	Clinical	NA		Skin prick test
U-BIOPRED	Clinical	NA		Sleep and daytime drowsiness: What parameters/tests?
U-BIOPRED	Clinical	NA		smoking status
ABIRISK	Clinical	NA		smoking status
U-BIOPRED	Clinical	NA		SNOT22??
U-BIOPRED	Clinical	NA		Sputum colour
U-BIOPRED	Clinical	NA		Sputum consistency
U-BIOPRED	Clinical	NA		Squeak
RA-MAP	Clinical	NA		The quality-adjusted life year or quality-adjusted life-year (QALY) is a measure of disease burden, including both the quality and the quantity of life lived. EQ-5D is a method for QALY.
Oncotrack	Clinical	NA		TNM Classification of Malignant Tumours (TNM) status
U-BIOPRED	Clinical	NA		Upper airways symptoms?? What parameters/tests?
RA-MAP	Clinical	NA		van der Heijde Sharp Modified score
U-BIOPRED	Clinical	NA		Vital signs: Which ones?
U-BIOPRED	Clinical	NA		Weight (kg)
U-BIOPRED	Clinical	NA		Wheeze
U-BIOPRED	Clinical	spirometry		?
RA-MAP	Clinical			erythrocyte sedimentation rate (ESR)
U-BIOPRED	Clinical?	?		Telemonitoring study: what is measured?
RA-MAP	Functional	?	tbd	in-vitro functional assays
Oncotrack	Functional	?		tumour growth values: RTV (Response Evaluation Criteria In Solid Tumors (RECIST)) and T/C; tumour growth curve (image)
U-BIOPRED	Functional	electrocardiogram		?
Oncotrack	Functional	NA		cell growth assay, IC50
U-BIOPRED	Functional	Plethysmography		lung volume
U-BIOPRED	Genomics	?	?	?
RA-MAP	Genomics	Array	Illumina	HumanOmni Beadchip
ABIRISK	Genomics	Array (SNP array specific to immune diseases (immunochi	?	?

		p))		
Oncotrack	Genomics	Array (SNP array specific to immune diseases (immunochip))	Illumina	HM450K
Oncotrack	Genomics	Array or Seq?	?	in situ Padlock analysis. Molecular Inversion Probe (MIP)[1] belongs to the class of Capture by Circularization molecular techniques
ABIRISK	Genomics	PCR?	?	mutation status
Oncotrack	Genomics or Transcriptomics?	NGS	SOLiD	?
Oncotrack	Genomics or Transcriptomics?	NGS	Illumina	HiSeq
U-BIOPRED	Imaging	Computerised tomography (CT) scans	?	
Oncotrack	Imaging	NA	?	histology images (HE-staining)
RA-MAP	Imaging	ultrasonography	?	
RA-MAP	Imaging	x-ray	?	
U-BIOPRED	Metabolomics	?	?	Blood Urea Nitrogen
U-BIOPRED	Metabolomics	?	?	Creatinine
U-BIOPRED	Metabolomics	?	?	Exhaled nitric oxide (NO): what techno?
U-BIOPRED	Metabolomics	?	?	Potassium
U-BIOPRED	Metabolomics	?	?	Sodium
U-BIOPRED	Metabolomics	?	?	Total bilirubin
U-BIOPRED	Metabolomics	?	?	urinary cotinine: what techno?
U-BIOPRED	Metabolomics	Electronic nose	Custom made AMC	eNose platform: Cyranose C320, Comon Invent eNose, Tor Vergata eNose, Owlstone Lonestar
U-BIOPRED	Metabolomics	Mass spectrometry: Electrospray ionization (ESI) –mass spectrometry	Advion, Inc.	NanoMate-ESI
U-BIOPRED	Metabolomics	Mass spectrometry: Gas Chromatography-mass spectrometry	TD system by Gerstel, GC system by Agilent, MS system by Leco	?
U-BIOPRED	Metabolomics	Mass spectrometry: Gas Chromatography-mass spectrometry	TD system by Markes, GC system by Agilent, MS system by Waters	?
U-BIOPRED	Metabolomics	Mass spectrometry: Gas chromatogra	Hewlett-Packard, Palo Alto, Calif	model Engine 5989B series II

		phy–mass spectrometry		
U-BIOPRED	Metabolomics	Mass spectrometry: high performance liquid chromatography (HPLC)-tandem mass spectrometry (MS/MS)	Shimadzu Scientific Instruments, Inc, Columbia, Md &Applied Biosystems, Foster City, Calif	Shimadzu Sil-2-AC & Qtrap 4000
U-BIOPRED	Metabolomics	Mass spectrometry: Liquid Chromatography-tandem mass spectrometry (MS/MS) Quadrupole time-of-flight mass spectrometer	?	?
U-BIOPRED	Metabolomics	Mass spectrometry: Ultra Performance Liquid Chromatography-tandem mass spectrometry (MS/MS) with multiple reaction monitoring (MRM)	Waters, Milford, USA	Acquity UPLC & Xevo TQ-S
U-BIOPRED	Metabolomics	Mass spectrometry: Ultra Performance Liquid Chromatography-tandem mass spectrometry (MS/MS) with multiple reaction monitoring	Waters, Milford, USA	Acquity UPLC & Xevo TQ-S/TQ-MS

		(MRM)		
U-BIOPRED	Metabolomics	Mass spectrometry? Shotgun lipidomics	?	?
RA-MAP	Metabolomics	Nuclear Magnetic Resonance (NMR)	?	1 Dimension on proton (1H) NMR
U-BIOPRED	Metabolomics?	?	?	Exhaled Breath Condensate
U-BIOPRED	Proteomics	?	?	Alanine transaminase (ALT)
U-BIOPRED	Proteomics	?	?	Albumin
U-BIOPRED	Proteomics	?	?	Alkaline phosphatase
ABIRISK	Proteomics	?	?	anti-drug antibody (ADA) levels
U-BIOPRED	Proteomics	?	?	Aspartate transaminase (AST)
RA-MAP	Proteomics	?		autoantibodies to IgGFc, known as rheumatoid factors (RF), and antibodies to citrullinated peptides (ACPA).
ABIRISK	Proteomics	?		Biological drug measurments. In medicine, a trough level is the lowest level that a medicine is present in the body. In a medicine that is administered periodically, the trough level should be measured just before the administration of the next dose in order to avoid overdosing
U-BIOPRED	Proteomics	?	?	C-reactive protein (CRP)
RA-MAP	Proteomics	?	?	C-reactive protein (CRP)
ABIRISK	Proteomics	?	?	C-reactive protein (CRP)
U-BIOPRED	Proteomics	?	?	Gamma-glutamyltransferase (Gamma-GT)
U-BIOPRED	Proteomics	?	?	Immuno Measures: what test?
Oncotrack	Proteomics	?	?	Immunofluorescence is not an assay. FACS?, immunohisto?
U-BIOPRED	Proteomics	?	?	Immunoglobulins E (IgE) dosing:what techno/methodology?
U-BIOPRED	Proteomics	?	?	lactate dehydrogenase (LDH)
ABIRISK	Proteomics	?	?	Serology (HIV, HpB, HepC)
U-BIOPRED	Proteomics	?	?	Total protein
Oncotrack	Proteomics	Array	?	Reverse Phase protein arrays
RA-MAP	Proteomics	Flow cytometry	?	Mean Fluorescence intensity
Oncotrack	Proteomics	Immuno assays	?	Immunohistochemistry
Oncotrack	Proteomics	Immuno assays	Licor/Odyssey	western blot
U-BIOPRED	Proteomics	Mass Spectrometry - Multiple reaction monitoring (MRM) via G2S full scan	Waters Corporation, Milford, Massachusetts, USA. 01757	Waters SYNAPT G2-Si High Definition Mass Spectrometry
U-BIOPRED	Proteomics	Mass Spectrometry - Nanoscale liquid chromatography coupled to Ion-mobility spectrometr	Waters Corporation, Milford, Massachusetts, USA. 01757	Waters SYNAPT G2-Si High Definition Mass Spectrometry

		y coupled to MSE(nano LC-IMS-MSE)		
Oncotrack	Proteomics	Modified time-resolved fluorescence plate readers	Ceznne or Edinburgh Instruments	time-resolved fluorescence energy transfer (TR-FRET)-assay
Oncotrack	Proteomics	Multiplex Solution phase Proximity ligation assay	?	Multiplex Solution phase Proximity ligation assay
ABIRISK	Proteomics	NA	?	ELISA
Oncotrack	Proteomics	Proximity ligation assay (in situ PLA)	?	Proximity ligation assay (in situ PLA)
RA-MAP	Proteomics		?	ELISA
ABIRISK	Proteomics			Liver function tests (LFTs)
Oncotrack	Proteomics or Imaging?	Time-resolved fluorescence imaging (inverted microscope + different cameras)	?	?
U-BIOPRED	Proteomics or Metabolomics?	?	?	Biochemistry tests
RA-MAP	Proteomics?	?	?	routine blood: FBC, creatinine, LFTs
U-BIOPRED	Transcriptomics	Array	Affymetrix	HG-U133 Plus 2.0
RA-MAP	Transcriptomics	Array	Illumina	HT-14 v4
Oncotrack	Transcriptomics	qRT-PCR	?	
ABIRISK	Transcriptomics	RNASeq	?	?
RA-MAP	Transcriptomics	RNASeq	Illumina	smallRNA, HiSeq
