

Clinical data towards multiomics

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Sensitive data management on IMTM



- Users and their rights
 - Information system Admin



- Storage of clinical/parametric data
 - Information system ClinData



- Storage of laboratory data
 - Information systems ClinLab, PreClinData, MedChemBio Portal, LabScheduler



- Storage of big omics data
 - Object storage CEPH, S3, OwnCloud, Samba



IMTM/EATRIS-CZ Digitalization Hub





Information system Admin



Users and their rights



IMTM Admin User administration



AUTHENTICATION (WHO IS WHO)

User definition: Name, mail, phone, organization, team



AUTHORIZATION (WHAT IS ALLOWED)

Two types of restrictions:

- Access to functionality
- Access to data

Privilege list	Entities with access to the selected Privilege				
🛟 new 🞗 delete 💿 reload 🄇 evictCache 🕀 🐵				Profile (355) Role (24)	
Name	Description			Name	Description
ROLE_USER		^	L	Laboratory 65Biocev	Role for adding patients
ROLE_REGISTRY	Registry		s	Supervisor	Role with all access rights.
ROLE_REGISTRY_DISPLAY_PERSONAL_DATA	Registry display personal data of all		I	Import data 65BIOCEV manager	Role for importing group of data
□ ROLE_REGISTRY_PATIENT	Registry patient		C	CovIT PREVAL sampling site ALL pa	user see all patients
□ ROLE_REGISTRY_PATIENT_INFORM_CONSENT	Registry show informed consent		N	Manager 65BIOCEV laboratory	Role for managing status of patients + SMS
ROLE_REGISTRY_PATIENT_INFORM_CONSENT_DELE1	Registry delete informed consent		C	CovIT basic role	
ROLE_REGISTRY_PATIENT_INFORM_CONSENT_ADD	Registry add informed consent		c	Clindata SARS students	
ROLE_REGISTRY_PATIENT_ADD_STUDY	Registry add patient to study		c	CovIT PREVAL sampling site NOTal	user do NOT see other patients
ROLE_REGISTRY_PATIENT_DEL_STUDY	Registry delete patient from study		s	Sampling site + Laboratory 5MOTO	. Sampling site and laboratory of 5MOTOL
□ ROLE_REGISTRY_PATIENT_FORM	Registry show patient's forms		N	Manager IMTM laboratory	Role for managing status of patients + SMS
ROLE_REGISTRY_PATIENT_FORM_EDIT	Registry edit patient's forms		c	ClinData project admin	Role with unrestricted access to selected pro
ROLE_REGISTRY_PATIENT_FORM_SHOW_HISTORY	Registry show form history		c	ClinData project data manager	Role maintains patiens in the study, no study
□ ROLE_REGISTRY_PATIENT_FORM_CHANGE_STATUS	Registry changes form's status		C	ClinData Disulfiram user	
ROLE_REGISTRY_PATIENT_FORM_CHANGE_STATL	Registry changes status to signed		I	Import data 53IMG manager	Role for importing group of data
ROLE_REGISTRY_PATIENT_FORM_FORCE_CLOSE	Registry force close form		l	Import data IMTM manager	Role for importing group of data
ROLE_REGISTRY_PATIENT_FORM_CHANGE_STATU	Registry changes status to close		L	Laboratory 42MUNIBRN	Role for adding patients
ROLE_REGISTRY_PATIENT_FORM_CHANGE_STATU	Registry changes status to review r		c	Covid ADMIN	
ROLE_REGISTRY_PATIENT_FORM_CHANGE_STATU	Registry changes status to signed		L	Laboratory IMTM	Role for adding patients
ROLE_REGISTRY_PATIENT_FORM_OPEN	Registry open patient's forms		L	Laboratory 53IMG	Role for adding patients
ROLE_REGISTRY_PATIENT_SHOW_OWNER	Registry show patients owner		s	Sampling site + Laboratory 75UK1L	Sampling site and laboratory of 75UK1LF
ROLE_REGISTRY_PATIENT_STUDY_DETAIL	Registry show patient in study		A	Admin of 42MUNIBRN laboratory	Role for managing status of patients + SMS +
ROLE_REGISTRY_PATIENT_STUDY_DETAIL_EXPORT	Registry export patient's data		s	Sampling site + Laboratory 1SZU	Sampling site and laboratory of 1SZU
ROLE_REGISTRY_PATIENT_STUDY_DETAIL_EDIT	Registry edit patient in study	~	c	ClinData Kopretina gynekolog	Role for gynocologists in Kopretina project
			N	Manager 53IMG laboratory	Role for managing status of patients + SMS

PRIVILEGE

Every feature in system has its own item in admin

ROLE

Virtual entity connecting more privileges together:

Registry add patient to study

- ClinData project admin
- ClinData principal investigator
- ClinData project data manager



Admin – data restrictions on record level

- Every record in database has these identifications
 - idPatient Unique ID of entity
 - idCreator ID of user who created record
 - idUpdater ID of user who edited record

TIMECREATOR	IDUPDATER	TIMEUPDATER	ACTIVE
28.06.24 12:12:25,00000000	(null)	28.06.24 12:12:25,00000000	1
14.06.24 14:47:25,00000000	(null)	14.06.24 14:47:25,00000000	1
28.06.24 11:57:29,00000000	(null)	28.06.24 11:57:29,00000000	1

- Every user is part of organization and team
 - Multilevel hierarchy





Admin – data restrictions on record level

- By default, a user can see only records he inserted
- Access permission/restriction can be limited to
 - Specific persons according to idPatient,
 - Persons inserted by specific user by idCreator,
 - Persons inserted by teammates of specific user.
 - Specific study or all persons inserted in study
 - Specific form(eCRF)
 - Specific event visit



Admin – user interface

🌃 Administration 👻 💥 Site configuratio	on ≖											
Person list				^	Profile(s) settings for selected Person							
🕒 new ጰ delete 💿 reload 🎯 e	evictCache					Profile list					<	
Email/Login	Last name	Name	Phone	Registered		🕒 new ጰ delete 📀 reload 🤇 ev	ictCache					
petr.pavlis						Name	Registered	Default				
netr navlik@unol.cz	Davlič	Detr	42073				~	~				
herihavis@abor.cz	r aviis	reu	1120/3			Pneumologicky registritest						
						Admin	✓					
						Data Manager						
					:	System admin	~					
											-	
Person details - edit					•	Settings for selected Profile <						
🔜 save 🛛 🛛 cancel						Role (7) Privilege (217)	Menu (25)	Permission (7)	Te	am (1)	Profile (12 🕨	
Email/Login * petr.pavlis@upol.cz			Regist	ered 🗹		⊕ ⊞						
Title First name *	Midle name	Last name *		Degree		Name			Selected	Subtree	Effective	
Petr		Pavliš							~	•	~	
Address												
Phone +4207311	www										▼ ▼	
Change password	Multifactor	Authentication if r	equested by CAS									
Password	N	ext authentication	after 3000 Typ	e SMS 🗸								
[min]												
						ROLE REGISTRY DISPLAY PER	SONAL DATA					



Admin – security management

- All changes in user accounts and their rights are controlled and monitored
- Creating new accounts or changes in privileges requires approval via IMTM Helpdesk system.
- There is at least once a year audit of user accounts and obsolete ones are disabled

IMTM Helpdesk Center / IT Support	
Raise this request on behalf of	
Pavlis Petr	~
Summary	
Description (optional)	
Aα~ Β I … ∷≡ ~ & <> + ~	
Priority (optional)	
Low	,
Attachment (optional)	
Drag and drop files, paste screenshots, or browse	



ClinData

Comprehensive information system for data stewardship in clinical trials, registries and other clinical/scientific databases.



ClinData – Parametric data storage

- ClinData software has web-based client/server architecture, the application runs on the server, the user is connected through a web browser from computer, tablet or smart phone.
- All communication between the client and the server is secured by SSL encryption, which is currently industry standard.
- Main aims was to end "Excel hell", but it was before GDPR.
- Available at <u>https://clindata.imtm.cz/</u>
- Manual: <u>https://confluence.imtm.cz/x/NAFp</u>
- Leaflet: <u>https://confluence.imtm.cz/x/VwCzBQ</u>





ClinData – basic schema





ClinData - study design

- Basic entity is **study**
- Study defines one or more events/visits (schedule)
- Study contains one or more electronic forms (eCRF)
- Every event can have one or more forms —
- Events can be planned, repeated or ad-hoc

Q Study details	CRF templates	🗎 Study flowchart	🖉 Uploaded files	Storage	Reports
🖬 Study flowch	art (visits)				
	• Add visit	id: 197 😗 🔽 id: 2	37 😮 🖵 id: 23	Visits 19 😮 🔽 id: 24	1 😧 🔽 id: 243 🙄
	Den	0 1. měsíc	c 2. měsíc	3. měsíc	6. měsíc
		all 🗌 all	all		
Zařazení pa	cienta 🔽				
Rodinná ana	amnéza 🔽				
Osobní ana	mnéza 🔽				
Laboratorní	výsledky 🗹				
Doplnění os anamnézy	obní 🗌		✓		
Krevní obra	z 🔽				
Testy	~				



ClinData – electronic form (eCRF)

- Form is split into sections logical order
- Basic element of the form is question
- Answer to the question can be any of following types

ß

000

[123

3,14

⊡]⊡

⊡]⊡

ð

- Binary
- Category
- Number
- Decimal number
- Text with whisperer
- Free text
- Clob
- Date/time/Datetime
- File

Autoimunitní o	nemocnění	🔾 Ano 🔿 Ne 🔿 Neuvedeno	
	Štítná žláza	Datum diagnózy	dd/mm/yyyy 🋗
	DM	Datum diagnózy	dd/mm/yyyy 🋗
	Celiakie	Datum diagnózy	dd/mm/yyyy 🋗
	Artritis	Datum diagnózy	dd/mm/yyyy 🋗



ClinData – electronic form

- Other editable options of questions
 - Graphical **design** (html, css)
 - Is mandatory
 - Is visible visibility can be defined by another question
 - Is private
 - Hidden to user without personal data permission
 - Default value is set
 - Settings done via SPEL script
 - Calculated value is set,
 - Weight and height=> BMI
 - Harmonization standard OHDCI Athena





ClinData – electronic form

- Sections or questions can be repeated
 - Allows enter data of unknown abundance

0			Section can be
	ID aliquot	IMTM-BIOBNK-P1-S00000124-A01	Tepealeu
	Tube number	4565654	
	Material to store	RC RNA celková v	
	Amount	12 ml ~	
	Storage temperature [C]	-80	
1			
	ID aliquot	IMTM-BIOBNK-P1-S00000124-A02	
	Tube number	4565655	
	Material to store	RC RNA celková	
	Amount	8 ml v section	
	Storage temperature [C]	-80	



ClinData – electronic form status

• eCRF have status

Status	Ir	n progres	S
Reopen		Close	Sign

- Data validation is processed when changing status
- Changing status requires specific **privilege**
- **Reopening** form requires specific privilege
- Clinical studies has these statuses
 - Not opened
 - In progress
 - Review ready
 - Closed
 - Closed + Signed

Open Niox analýza exhalovaného NO	13/06/2019	Closed	2/2	0/0
Open Spirometrie	13/06/2019	In progress	2/10	0/0
🖸 Open Léčba astmatu	13/06/2019	Closed	4/5	0/0
Open Biologický materiál pro studii	13/06/2019	Closed	5/6	0/0



ClinData – electronic form designer

- Web designer
 - No IT specialists needed
 - Web interface to define forms, questions and all its parameters
 - Preview
 - Exporting templates to pdf.

orm name: Data security	Desc	ription: a security	Version:	Add new section -	O Browse history →	Preview	± Save
Section 🗸	Data security	Description:			0 ¢ ■ Repeatab	• • New grou Die I	p
₫	Text: What provisions are in place f data security (including data recovery as well as secure storage and transfer of sensit data)?	ToolTip: for			Layout		0 🗈 ×
© ©-0-	Text: Is the data safely stored in certified repositories for long term preservation and curatio	ToolTip: on?	Items: Yes	~	Layout		0
						Oltem ON	lew group

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ClinData – user interface

ClipD	Patient's data	×	₩
CIIID	Columns selection	() ()	
0 Pati	Search	Selected columns	
- Fau	Available columns	Action	t
Filters	Patient parameters	ID	
Seard	➡ Action	First name	
	→ ID		
	 First name 	Last name plumn	IS
Show	→ Last name	Address	
Actio	➡ Address		
Actio	 Sex Birth date 	Sex 🗶 🔤	
🔲 Op	Enrollment date	Birth date	
	Last undate		
🔳 Op	Personal ID	Enrollment date	
	→ Email		_
🔲 Op	→ Telephone	Last update	
	 Health insurance 		_
🔲 Op	→ Status		
	 Assignment to group 		-
Showin			
_		ext	
		Save Cancel	
© 2024 I	МТМ	2.5.5-RELEAS	SE



ClinData – status of electronic forms

Forms in the s	study A-C-G-T			C PDF 🗸	🕑 Expo	rt patient's data 🗸
Overall comp All: 142/3	letion of items on all forms 04 Mandatory: 11/11					
Action	Name	Last modification	Status		Comp All	letion 😉 Mandatory
🖸 Open	Centrum	17/07/2020	In progress	_	1/1	1/1
🖸 Open	Region účastníka	17/05/2021	Closed	_	4/5	0/0
🖸 Open	Vstupní a vylučovací kritéria	20/08/2020	Closed	_	6/7	5/5
🖸 Open	Identifikace vzorku	26/01/2021	In progress	_	2/2	0/0
🖸 Open	Dotazník pro dárce krve	22/07/2020	In progress	_	59/85	0/0
🖸 Open	Informovaný souhlas	21/08/2020	In progress	_	15/15	0/0
🖸 Open	Dotazník účastníka projektu	13/04/2023	In progress	_	32/137	5/5
🖸 Open	Laboratoř - A-C-G-T	24/11/2022	In progress	_	22/39	0/0
🖸 Open	Výsledkový formulář		Not opened		0/3	0/0
🖸 Open	Předání alikvotů		Not opened		0/9	0/0
🖸 Open	Data files		Not opened		0/0	0/0
🖸 Open	SEKVENACE - projekt	01/06/2023	In progress	_	1/1	0/0



ClinData – eCRF examples

	Study	A-C-G-T	Status In progress	L Back to patient	
	1 Laborat	orní wisledky V			
Soubory 🗸					
	WGS	3_UP0001_210628_A00703_0086_ 3_UP0001_210628_A00703_0086_	_AHVYJ3D\$XY_\$3_R1_001.fastq.gz		
	aCGH				
	Metab	olomics			
	metDN	IA Seq			



ClinData – FAIRification

- Selected data from selected studies can be exported into public repositories
 - Cancer genomics data is exported into IMTM instance of cBioPortal <u>https://cbioportal.imtm.cz</u>
 - Data from other types of studies is exported to LifeData portal <u>https://lifedata.cz</u>
- Data exported into public repositories are anonymized, curated and possibly aggregated.



ClinData – FAIRification



https://cbioportal.imtm.cz







ClinData – license

- ClinData is completely developed on IMTM/EATRIS-CZ UPOL.
- All external libraries/frameworks used in ClinData are published under permissive open software licenses like MIT, BSD, Apache.
- There are no external license requirements on using ClinData.
- ClinData is not currently an open source, but willing to provide free license for non-commercial use.



ClinLab

Laboratory information system for management of samples from various projects.

ClinLab Laboratory information system

Based on CovIT

Specialized system for management of Sars-Cov2 samples



Functionality of LIMS for single laboratory procedure



Evidence and management of samples in IMTM biobank

Other LIMS functionality planned and being developed

https://clinlab.imtm.cz/



ClinLab Sampling



Informed consent signed



Biobanking - odběrové místo	Status In progress	Save and close Close	Save and close Close		
Vzorky - odběrové místo		CRF history C Pd	if -		
Jméno		Příjmení			
Rodné číslo	/				
Pohlaví	○ M ○ F	Datum narození DD	D/MM/RRR		
Telefonní číslo	telephone	Email			
Město		PSČ			
Zdravotní pojišťovna			~		

Příjem vzorku 🗸	
Datum odběru	
Typ materiálu na příjmu *	v
Externí ID vzorku I.	
Externí ID vzorku II.	
Externí ID vzorku III.	

Informovaný souhlas 🗸

Informovaný souhlas je k 🛛 🔿 Ano 🔿 Ne dispozici





Action ID Address Birth date Enrollment date First name Last name Sex 🗏 Open 🛛 💙 1 Jan Novák Μ 1972/01/01 2024/06/14 14:47:25 🖈 SMS 🛛 🗹 Open Form: Vzorky Visit: default Visit date: 14/06/2024 25/29 🖈 SMS 🛛 🗹 Open Visit: default Vi Sample storage 🗸 Vi 🖈 SMS 🛛 🗹 Open Visit: default Date of receiving sample 14/06/2024 + New sample Visit: default Reason Indication by a doctor O Study ID sample IMTM IMTM-null-P1-S00000124 Number of aliquots 1 • 0 Extraction of IMTM-null-P1-S00000124-A01 ID aliquot 4565654 Tube number aliquots Material to store RC RNA celková \sim 12 ml Amount \sim -80 Storage temperature [C]

ClinLab Laboratory methods and results

Methods has specific form to fill laboratory results

Provedená vyšetření genetiky nádoru	Výsledek vyšetření mutačního stavu		Byl vyšetřen subtyp	Subtyp
fúze AKT1	negativní	~	ano v	Type to start searching
mutace AKT1	pozitivní	~	ne v	Type to start searching
fúze ALK	negativní	~	ne v	Type to start searching
mutace ALK	pozitivní	~	ano v	Type to start searching
fúze AXL		~	~	Type to start searching
fúze BRAF		~	~	Type to start searching
mutace BRAF		~	~	Type to start searching
fúze CCND1		~	~	Type to start searching
mutace CTNNB1		~	~	Type to start searching

If confirmed, than select stage rASRM	\bigcirc I \bigcirc II \bigcirc III	O IV	
No adenomyosis	🔿 Yes 🔿 No		
No previous gynecological/pelvic surgery except for HSC, polypectomy, laparoscopy, salpingectomy	🔾 Yes 🔵 No		
No hyperprolactinaemia	🔿 Yes 🔿 No		
FSH on the third day	less than 10	IU/L	[less than 10]
Anti-Mullerian hormone	1 - 5	µg/L	[limit value 1-5]
Basal antral follicle count	5 - 15		[limit value 5-15
No polycystic ovary syndrome	🔾 Yes 🔘 No		
Number of deliveries			
Number of spontaneous abortions	less than 2		[less than 2]
Infertility duration	less than 5	years	[less than 5]



ClinLab – ComfortLab portal Reporting, PDF, HTML

Direct communication channel with patients or doctors

- Gathering patient's data via predefined registration forms
- Patients can receive results or certificates
- Authentication by information sent via SMS or emails
- Login by personal id and unique hash value sent in SMS



ClinLab Connection to European bio bank BBMRI

Samples registered in ClinLab can be reported to BBMRI European bio bank





Data management of omics data

- New problem arises here data size
- When new omics project is coming then IT guys must pay attention.
- Problem is not only storage place, but also network nad CPU speed.
- When we exchange big data with externals then a week is good time
- 10/25/100Gb network speed sounds good but real speed is much slower





CEPH – Big omics data storage

ClinData software is connected to IMTM Object storage which allows storing of big scientific data (genomic, proteomics) in safe way. Capacity of the object storage is 2.5PB. Objects can be directly linked to ClinData forms to allow accessing all data from one place.





Sharing omics data





Future plans with omics data?

- Enhance previous screen by installing and adopting FEGA
 - FEGA is Federated European Genome/Fenome archive
 - <u>https://ega-archive.org/about/projects-and-funders/federated-ega/</u>





Thank you for you attention!