# FWO DMP Template - Flemish Standard Data Management Plan

# **Version KU Leuven**

Project supervisors (from application round 2018 onwards) and fellows (from application round 2020 onwards) will, upon being awarded their project or fellowship, be invited to develop their answers to the data management related questions into a DMP. The FWO expects a **completed DMP no later than 6 months after the official start date** of the project or fellowship. The DMP should not be submitted to FWO but to the research co-ordination office of the host institute; FWO may request the DMP in a random check.

At the end of the project, the **final version of the DMP** has to be added to the final report of the project; this should be submitted to FWO by the supervisor-spokesperson through FWO's e-portal. This DMP may of course have been updated since its first version. The DMP is an element in the final evaluation of the project by the relevant expert panel. Both the DMP submitted within the first 6 months after the start date and the final DMP may use this template.

The DMP template used by the Research Foundation Flanders (FWO) corresponds with the Flemish Standard Data Management Plan. This Flemish Standard DMP was developed by the Flemish Research Data Network (FRDN) Task Force DMP which comprises representatives of all Flemish funders and research institutions. This is a standardized DMP template based on the previous FWO template that contains the core requirements for data management planning. To increase understanding and facilitate completion of the DMP, a standardized **glossary** of definitions and abbreviations is available via the following link.

	1. General Project Information
Name Grant Holder & ORCID	Karin Haustermans (ORCID: 0000-0003-0364-682X ), KU Leuven, PI
Contributor name(s) (+ ORCID) & roles	Maarten Lambrecht (ORCID: 0000-0002-8746-2691), KU Leuven, co-supervisor
	Yolande Lievens (ORCID: 0000-0002-9157-3730), Universiteit Gent, co-supervisor
	Gilles Defraene (ORCID: 0000-0002-3622-4925), KU Leuven, co-worker
Project number <sup>1</sup> & title	Towards cost-effective patient selection for proton therapy in thoracic cancers: a framework for continuously updating prediction models (FWO-TBM project)
Funder(s) GrantID <sup>2</sup>	T005523N
Affiliation(s)	图KU Leuven
	☐ Universiteit Antwerpen
	图Universiteit Gent
	☐ Universiteit Hasselt
	□ Vrije Universiteit Brussel
	□ Other:
	ROR identifier KU Leuven: 05f950310

<sup>&</sup>lt;sup>1</sup> "Project number" refers to the institutional project number. This question is optional. Applicants can only provide one project number.

<sup>&</sup>lt;sup>2</sup> Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

Please provide a short project description

The rapid evolution of state-of-the-art treatments for thoracic cancers leads to a systematic underperformance of published prediction models of toxicity, i.e., normal tissue complication probability (NTCP) models, in recently treated patients. This implies a suboptimal NTCP model-based planning of photon-based radiotherapy (XT) and errors in NTCP model-based patient selection for the potentially beneficial but more expensive proton therapy (PT). Our hypothesis is that prospectively learning from every patient could detect early the treatment-related changes relevant for the outcome, leading to the necessary NTCP model revisions. We will therefore build a framework for continuous prediction model updating and will evaluate its functioning using literature-based simulations and existing retrospective patient cohorts. The framework will then be used prospectively during the introduction of PT in esophageal cancer (European PROTECT phase III trial randomizing between XT and PT, currently running in the Particle Therapy Interuniversity Center Leuven) and lung cancer (XT and PT data from international collaborations) in order to detect XT/PT-related changes in toxicity outcome. Innovative NTCP modeling will be developed to fit the new PT era data by focusing on linear energy transfer maps. Weekly repeated 4DCT scans and adapted treatment plans will inform the optimization of novel intra-treatment NTCP models for the adaptation era. Finally, the benefit the framework would have had in a setting of model-based patient selection for PT will be quantified. For this purpose a health economic assessment will be associated to the NTCP model framework, taking into account cost parameters to weigh the cost savings related to the predicted decreased risk of side effects with PT and its higher operational costs compared to XT.

# 2. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data <sup>3</sup>.

				ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR PHYSICAL DATA
Dataset Name	Description	New or Reused	Digital or Physical	Digital Data Type	Digital Data Format	Digital Data Volume (MB, GB, TB)	Physical Volume
		☐ Generate new data ☐ Reuse existing data	☐ Digital ☐ Physical	☐ Audiovisual ☐ Images ☐ Sound ☐ Numerical ☐ Textual ☐ Model ☐ Software ☐ Other:		☐ < 1 GB ☐ < 100 GB ☐ < 1 TB ☐ < 5 TB ☐ > 5 TB ☐ NA	
Eso_UZL_clin	Initial outcome analysis data	Reuse	Digital	Images, Textual	DICOM, .csv	<100 GB	
Eso_UZL_dos	Dosiomics data	Generate	Digital	Numerical, Model	. CSV	<1GB	
Lung_UZL_clin	Initial outcome analysis data	Reuse	Digital	Images, Textual	DICOM, .csv	<100 GB	
Lung_UZL_dos	Dosiomics data	Generate	Digital	Numerical, Model	. CSV	<1GB	
Eso_MDA_clin	Initial outcome analysis data (MD Anderson)	Reuse	Digital	Images, Textual	DICOM, .csv	<100 GB	
Eso_MDA_dos	Dosiomics data	Generate	Digital	Numerical,	. CSV	<1GB	

<sup>&</sup>lt;sup>3</sup> Add rows for each dataset you want to describe.

	(MD Anderson)			Model		
Lung_REQ_clin	Initial outcome analysis data (REQUITE)	Reuse	Digital	Images, Textual	DICOM, .csv	<100 GB
Lung_REQ_dos	Dosiomics data (REQUITE)	Generate	Digital	Numerical, Model	. CSV	<1GB
Lung_MAA_clin	Initial outcome analysis data (MAASTRO)	Reuse	Digital	Images, Textual	DICOM, .csv	<100 GB
Lung_MAA_dos	Dosiomics data (MAASTRO)	Generate	Digital	Numerical, Model	. CSV	<1GB

### GUIDANCE:

The data description forms the basis of your entire DMP, so make sure it is detailed and complete. It includes digital and physical data and encompasses the whole spectrum ranging from raw data to processed and analysed data including analysis scripts and code. Physical data are all materials that need proper management because they are valuable, difficult to replace and/or ethical issues are associated. Materials that are not considered data in an RDM context include your own manuscripts, theses and presentations; documentation is an integral part of your datasets and should described under documentation/metadata.

RDM Guidance on data

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type.

- 1. Esophageal cancer radiotherapy datasets (±650 patients):
- Prospective dataset collected in UZ Leuven, supervised by prof. Karin Haustermans, containing >300 patients treated with photon-based radiotherapy. Required dosimetric (DVH files in text format, RT STRUCT, RT DOSE and RT PLAN files in DICOM format, all extracted from radiotherapy treatment planning software), imaging (planning CT and daily CBCT image files, in DICOM format), clinical (treatment-related patient characteristics, extracted from a surgery department's database, in csv format) and outcome (survival and toxicity endpoints scored by the physician, in csv format) data is available and will be reused [1]. This dataset will be updated during the course of the project at a rate of around 20 new patients/year.
- Dataset of MD Anderson, with patients partly treated with proton therapy (320 patients), containing similar information (DVH files, clinical and outcome data). We plan to additionally collect the DICOM files of these patients during a work visit at the MD Anderson Cancer Center.
- → Estimated volume: 100 Gb

- 2. Lung cancer radiotherapy datasets (±500 patients):
- We have agreed with the consortium of the REQUITE project (observational EU study (2014-2017) including KU Leuven/UZ Leuven as partner) to use its multicentric lung cancer database. This dataset will contain the CT, RT STRUCT, RT DOSE and RT PLAN data in DICOM format of >350 photon-based patient treatments, together with physician-rated and patient-reported outcome (PRO) measures of pulmonary, cardiac and esophageal toxicity outcome with 24 months follow-up, in csv format [2].
- A prospective collection of clinical, DICOM and PRO data of lung cancer patients in UZ Leuven is set up in collaboration with prof. Maarten Lambrecht and the department of pneumology. A dataset of approximately 150 patients will be similarly collected. This recent dataset will contain treatments with the new standard of care immune checkpoint inhibitor agents.
- Dataset of MAASTRO, with patients partly treated with proton therapy (300 patients), containing similar information (DVH files, clinical and outcome data).

→Estimated volume: 80 Gb

A specific ethical approval was obtained for reusing and updating all of the UZ Leuven datasets in the context of the radiation-induced toxicity prediction modeling studies as described in the different work packages of this project. For the external datasets DTAs will be set up during the first project year.

3. Results generated: 3D dose map features versus time in csv format (WP1), radiomics image feature values in csv format (WP2), LET and variable RBE calculations of proton therapy plans in DICOM format (WP3) and lung ventilation data in DICOM format (WP4) will be extracted from the DICOM data of described datasets; Matlab scripts (.m files), data structure files (.mat files) and figures will be generated; plots will be stored for visualization in .tiff format.

→Estimated volume: 20 Gb

[1] M. Thomas, G. Defraene, M. Lambrecht, W. Deng, J. Moons, P. Nafteux, SH. Lin, K. Haustermans. NTCP model for postoperative complications and one-year mortality after trimodality treatment in oesophageal cancer. Radiother Oncol, 141 (2019), pp. 33-40.

[2] P. Seibold, A. Webb, M.E. Aguado-Barrera, D. Azria, C. Bourgier, M. Brengues, et al. Requite: A

	prospective multicentre cohort study of patients undergoing radiotherapy for breast, lung or prostate
	cancer. Radiother Oncol, 138 (2019), pp. 59-67.
Are there any ethical issues concerning the	☑ Yes, human subject data; provide SMEC or EC approval number:
creation and/or use of the data	☐ Yes, animal data; provide ECD reference number:
(e.g. experiments on humans or animals, dual	☐ Yes, dual use; provide approval number:
use)? If so, refer to specific datasets or data	□ No
types when appropriate and provide the	Additional information:
relevant ethical approval number.	
	Ethical Committee approval was obtained from the Medical Ethical Committee of UZ Leuven:
	1. Esophageal cancer radiotherapy datasets: file S59667 was approved for the collection and use of the UZ
	Leuven and MD Anderson data in the context of this project. A Data Transfer Agreement between MD
	Anderson and UZ Leuven was previously put in place and will be updated for DICOM data.
	2. Lung cancer radiotherapy datasets: file S56556 was approved for the REQUITE study data collection. In
	addition, a Data Transfer Agreement between the REQUITE coordinating institution and UZ Leuven was
	obtained. File S59762 was approved for the collection and use of UZ Leuven lung cancer data.

Will you process personal data <sup>4</sup> ? If so, please	
refer to specific datasets or data types when	□ No
appropriate and provide the KU Leuven or UZ	Additional information:
Leuven privacy register number (G or S number).	
	Ethical Committee approval was obtained for all described UZ Leuven datasets: S59667 (esophageal cancer
	datasets), S56556 (REQUITE study lung cancer dataset) and S59762 (UZ Leuven lung cancer dataset). DTA
	will be set up for the use of external datasets of MD Anderson and MAASTRO.
	Clinical and treatment-related patient data including age, gender, BMI, smoking, comorbidities, tumour
	histology and stage, date of surgery, etc.; survival and postoperative complication and toxicity data; DICOM
	CT and CBCT imaging data and DICOM radiotherapy treatment planning data.
	All these data structures will be pseudonymized, including the removal of all patient-related tags from the
	DICOM files. Data will be subsequently stored in the secured 'UZ data' repository within the UZ Leuven
	hospital environment. A file with the links between individual patient identifiers and pseudonymization code
	numbers will be stored in a separate location.
Does your work have potential for commercial	☐ Yes
valorization (e.g. tech transfer, for example spin-	⊠ No
offs, commercial exploitation,)?	If yes, please comment:
If so, please comment per dataset or data type	
where appropriate.	In case results with potential for patenting are obtained, this will be discussed with KU Leuven LRD.
Do existing 3rd party agreements restrict	⊠ Yes
exploitation or dissemination of the data you	□ No
(re)use (e.g. Material/Data transfer agreements,	If yes, please explain:
research collaboration agreements)?	
If so, please explain to what data they relate and	REQUITE study lung cancer dataset:
what restrictions are in place.	-The multicentric data we will receive can only be used within the context of the detailed research plan we
	submitted (and which was approved by the REQUITE consortium's Publications Committee).
	-A general publication agreement was set up by the consortium regulating all dissemination activities and co-
	autorship guidelines when using data contributed by participating centers.

<sup>&</sup>lt;sup>4</sup> See Glossary Flemish Standard Data Management Plan

Are there any other legal issues, such as	☐ Yes
intellectual property rights and ownership, to be	⊠ No
managed related to the data you (re)use?	If yes, please explain:
If so, please explain to what data they relate and	
which restrictions will be asserted.	

## 3. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep **data understandable and usable**, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

RDM guidance on documentation and metadata.

- .csv data: every patient is allocated a pseudonymization code number, per cancer type starting from 000 and with numbers increasing with the date of treatment.
- Scripts: all Matlab and Python scripts generated during the analyses will be stored in a specific 'UZ data' subfolder per research question (mostly coinciding with the subheadings in the different work packages of the project). Commenting will be used throughout the scripts to explain the steps followed when running scripts during the analyses.
- Per research question a 'read me' file detailing the required input data, analysis scripts and how to run them, and the resulting output data and plots obtained, will be generated.

Will a metadata standard be used to make it easier to **find and reuse the data**?

If so, please specify which metadata standard will be used. If not, please specify which metadata will be created to make the data easier to find and reuse.

REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.

☐ Yes

 $\bowtie$  No

If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used:

If no, please specify (where appropriate per dataset or data type) which metadata will be created:

- Data will be structured in subfolders of the overall project folder according to the research question ( work package) and cancer type (esophageal cancer and lung cancer).
- Radiotherapy terminology will be used to describe the dosimetric parameters derived from the patient's radiotherapy treatment plans, i.e., mean organ doses, maximal organ doses, volumes of the organ receiving a certain dose level, etc.
- DICOM files contain by default a lot of metadata: date of scan acquisition, voxel size and slice thickness, kV energy, radiotherapy planning details, etc.
- All generated scripts, results files, plots, etc. will be named according to work package, cancer type and date of generation.

# 4. Data Storage & Back-up during the Research Project

☐ Shared network drive (J-drive)
☐ Personal network drive (I-drive)
☐ OneDrive (KU Leuven)
☐ Sharepoint online
☐ Sharepoint on-premis
☐ Large Volume Storage
☐ Digital Vault
☑ Other:
Collected study data and generated analysis results files will be stored in a 'UZ data' folder protected by a
password within the UZ Leuven hospital's network environment.
☐ Standard back-up provided by KU Leuven ICTS for my storage solution
☐ Personal back-ups I make (specify)
☑ Other (specify)
Automatic backup by IT of UZ Leuven of all folders in the 'UZ data' location every hour. If required, any folder
content can be restored to a previous time point.
□ No
If no, please specify:
The required ~200 Gb storage capacity is well within the limits of the allocated 'UZ data' space.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?	Password protection set on the 'UZ data' folder by IT department of UZ Leuven. Only access and writing rights for appointed users.
CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY, NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND TRANSFERRED DATA ARE SAFE. Guidance on security for research data	
What are the expected costs for data storage and backup during the research project? How will these costs be covered?	<ul> <li>No additional costs for the use of the 'UZ data' repository for researchers with a UZ Leuven network login.</li> <li>Yearly license of the data analysis software Matlab (125 euro/year through KU Leuven IT) required to generate and run the analysis scripts. This cost will be covered by the FWO-TBM's projects budget.</li> </ul>

# Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...). Suidance on data preservation Suidance on data preservation Wall data will be preserved for 10 years according to KU Leuven RDM policy All data will be preserved for 25 years according to CTC recommendations for clinical trials with medicinal products for human use and for clinical experiments on humans Certain data cannot be kept for 10 years (explain)

Where will these data be archived (stored and	☐ KU Leuven RDR
curated for the long-term)?	☐ Large Volume Storage (longterm for large volumes)
	☐ Shared network drive (J-drive)
<u>Dedicated data repositories</u> are often the best place	☑ Other (specifiy):
to preserve your data. Data not suitable for	
preservation in a repository can be stored using a KU	'UZ data' folder within UZ Leuven network environment. This folder will remain available as long as required.
Leuven storage solution, consult the interactive KU	
<u>Leuven storage guide</u> .	
What are the expected costs for data	There are no costs for the use of 'UZ data' folders.
preservation during the expected retention	
period? How will these costs be covered?	

	6. Data Sharing and Reuse
Will the data (or part of the data) be made available for reuse after/during the project? Please explain per dataset or data type which data will be made available.	<ul> <li>☐ Yes, as open data</li> <li>☐ Yes, as embargoed data (temporary restriction)</li> <li>☒ Yes, as restricted data (upon approval, or institutional access only)</li> <li>☐ No (closed access)</li> </ul>
NOTE THAT 'AVAILABLE' DOES NOT NECESSARILY MEAN THAT THE DATA SET BECOMES OPENLY AVAILABLE, CONDITIONS FOR ACCESS AND USE MAY APPLY. AVAILABILITY IN THIS QUESTION THUS ENTAILS BOTH OPEN & RESTRICTED ACCESS. FOR MORE INFORMATION:  https://wiki.surfnet.nl/display/standards/info-eu-repo/#infoeurepo-AccessRights	□ Other, please specify:
If access is restricted, please specify who will be able to access the data and under what conditions.	Researchers with an elaborated and collaborative plan for advancing the field of radiotherapy toxicity prediction modelling.

Are there any factors that restrict or prevent the	☐ Yes, privacy aspects
sharing of (some of) the data (e.g. as defined in	☐ Yes, intellectual property rights
an agreement with a 3rd party, legal	☐ Yes, ethical aspects
restrictions)? Please explain per dataset or data	☐ Yes, aspects of dual use
type where appropriate.	⊠ Yes, other
	If yes, please specify:
	For the REQUITE study lung cancer dataset, the REQUITE consortium (which we are a partner of) approved
	that non-partner institutions can only use (part of) the consortium database upon request of a detailed study
	proposal and a payment of a fee per patient.
	proposal and a payment of a ree per patient.
Where will the data be made available?	☐ KU Leuven RDR
If already known, please provide a repository	☐ Other data repository (specify)
per dataset or data type.	□ Other (specify)
per addaset or adda type.	Z Ctrick (openity)
	Upon request by mail.
	opon request by mail.
When will the data be made available?	☐ Upon publication of research results
When will the data be made available.	☐ Specific date (specify)
	□ Specific date (specify)     □ Other (specify)
	Es Other (specify)
	Upon reasonable request after our work has been published on the respective topic, and after approval of a
	Data Transfer Agreement by the Ethical Committee of the University Hospitals of Leuven.
	Data Transfer Agreement by the Ethical Committee of the Oniversity Hospitals of Ledven.

Which data usage licenses are you going to	☐ CC-BY 4.0 (data)
provide? If none, please explain why.	□ Data Transfer Agreement (restricted data)
	☐ MIT licence (code)
A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE	☐ GNU GPL-3.0 (code)
REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENCE IS	☐ Other (specify)
GRANTED, THE DATA ARE IN A GREY ZONE AND CANNOT BE LEGALLY	
REUSED. DO NOTE THAT YOU MAY ONLY RELEASE DATA UNDER A	
LICENCE CHOSEN BY YOURSELF IF IT DOES NOT ALREADY FALL UNDER	
ANOTHER LICENCE THAT MIGHT PROHIBIT THAT.	
Check the <u>RDR quidance on licences</u> for data and	
software sources code or consult the <u>License selector</u>	
tool to help you choose.	
Do you intend to add a PID/DOI/accession	☐ Yes, a PID will be added upon deposit in a data repository
- <b> </b>	= 100, a 112 mm be daded apon deposit in a data repository
number to your dataset(s)? If already available,	☐ My dataset already has a PID
number to your dataset(s)? If already available,	
	☐ My dataset already has a PID
number to your dataset(s)? If already available, please provide it here.	☐ My dataset already has a PID
number to your dataset(s)? If already available,	☐ My dataset already has a PID
number to your dataset(s)? If already available, please provide it here.  INDICATE WHETHER YOU INTEND TO ADD A PERSISTENT AND UNIQUE	☐ My dataset already has a PID
number to your dataset(s)? If already available, please provide it here.  Indicate whether you intend to ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.	☐ My dataset already has a PID ☐ No
number to your dataset(s)? If already available, please provide it here.  Indicate whether you intend to ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.  What are the expected costs for data sharing?	☐ My dataset already has a PID
number to your dataset(s)? If already available, please provide it here.  Indicate whether you intend to ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.	☐ My dataset already has a PID ☐ No

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	Dr. Gilles Defraene, postdoctoral researcher, possibly in collaboration with PhD students.
Who will manage data storage and backup during the research project?	UZ Leuven IT
Who will manage data preservation and sharing?	Dr. Gilles Defraene
Who will update and implement this DMP?	prof. Dr. Karin Haustermans, PI