Fast-track Delphi: user guide

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# Preface

## Purpose

This guide gives an overview of the toolkit to conduct a *fast-track Delphi* process (DelphiFT) and the steps for the analysis.

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| --- |
| Note |
| The fast-track Delphi is a process developed by [Unisanté](https://www.unisante.ch/), aiming to rapidly build consensus among scientific experts on a topical issue in order to support political decisions in a context of public health crisis.  The process consists in three rounds of consultation of experts. The experts (participants) are brought together in a first round during which a series of topics/questions/statements are collected and prioritized using an adapted version of the nominal group technique (NGT). The experts then express their opinion on these statements by responding individually to questions in the second and third rounds using an online questionnaire built with [**REDCap**](https://projectredcap.org/). Rational for the methodology and detailed results of the testing phase can be found in [publications](#sec-publications).  In order to produce results in a very short time frame, we developed an [R project](https://r4ds.had.co.nz/workflow-projects.html) that connects with [**REDCap**](https://projectredcap.org/) to download and process the data, and produce result reports in an **editable word document** format:   * a generic report and individualised reports for the second round (dft2) * a generic report and individualised reports for the third round (dft3) * an overall executive summary |

We suggest you first discover the demo to understand what you will produce, using the [fast-track Delphi: code with demo data and results](https://github.com/Unisante/delphi-fast-track-demo) available on GitHub (see also [Chapter 3](#sec-demo))

To start your own project, download the [fast-track Delphi: code only](https://github.com/Unisante/delphi-fast-track) available on GitHub and follow this user guide.

## Softwares and packages

* Interface and language: [**RStudio**](https://www.rstudio.com/) and [**R Statistical Software**](https://www.r-project.org/)
* Obtain data: [**REDCapR**](https://ouhscbbmc.github.io/REDCapR/) (not necessary for the demo)
* Data management, analysis and visualisation: mainly [**data.table**](https://rdatatable.gitlab.io/data.table/), with some [**tidyverse**](https://www.tidyverse.org/) and other packages. Regex expressions are sometimes used.
* Reports: [**officedown**](https://ardata-fr.github.io/officeverse/officedown-for-word.html) which builds on [**bookdown**](https://pkgs.rstudio.com/bookdown/), and [**flextable**](https://davidgohel.github.io/flextable/) from the [**officeverse**](https://ardata-fr.github.io/officeverse/index.html)

# Fast-track Delphi Toolkit

This document is part of a toolkit:

* Code only
* Demonstration set (code, anonymized dataset and outputs)
* User guide

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# Credits

This manual is a [quarto book](https://quarto.org/docs/books/).

We want to warmly thank all the people who developed the libraries we used for this work.

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# Conferences

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2. Velarde Crézé C, Lebon L, Duperrex O, Faivre V, Pasche M, Cornuz J. Cigarettes électroniques jetables de type puffs : consensus d’expert-e-s sur leur réglementation. Poster presented at: 16e Congrès de la Société Francophone de Tabacologie; 2022 Nov 24-25; Dijon, France. Available from: <http://csft2022.fr/>
3. Velarde Crézé C, Lebon L, Duperrex O, Faivre V, Pasche M, Cornuz J. Puff-like disposable electronic cigarettes – Expert consensus on their regulation using a fast-track Delphi process. Presentation at: Congrès de printemps de la Société Suisse de Médecine Interne Générale; 2023 May 10-12; Basel, Switzerland. Available from: <https://congress.sgaim.ch/fr/congres-de-printemps>

# Publications

1. Velarde Crézé C, Lebon L, Duperrex O, Faivre V, Pasche M, Cornuz J. Nouvelles cigarettes électroniques jetables « puffs » : consensus d’expert-e-s sur leur réglementation. Revue Médicale Suisse. 2023;19(812):181‑5. DOI: [10.53738/REVMED.2023.19.812.181](https://doi.org/10.53738/revmed.2023.19.812.181)
2. Velarde Crézé C, Zürcher K, Duperrex O, Flahault A, Cornuz J. La recherche de consensus scientifique pour promouvoir le lien entre science et politiques publiques. Rev Med Suisse. 2024 Jan 31;20(859):230–4. DOI: [10.53738/REVMED.2024.20.859.230](https://doi.org/10.53738/revmed.2024.20.859.230)
3. Velarde Crézé C, Duperrex O, Lebon L, Faivre V, Pasche M, Cornuz J. A multi-stage approach to support timely health policy decisions during crisis: the fast-track Delphi. BMC Public Health. 2024. DOI: [10.1186/s12889-024-20903-0](https://doi.org/10.1186/s12889-024-20903-0)

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| Expand for Session Info |
| Warning: le package 'sessioninfo' a été compilé avec la version R 4.4.2  ─ Session info ───────────────────────────────────────────────────────────────  setting value  version R version 4.4.1 (2024-06-14 ucrt)  os Windows 11 x64 (build 22631)  system x86\_64, mingw32  ui RTerm  language (EN)  collate French\_Switzerland.utf8  ctype French\_Switzerland.utf8  tz Europe/Zurich  date 2024-12-03  pandoc 3.2 @ C:/DATA/R.Apps/RStudio-2024.09.1-394/resources/app/bin/quarto/bin/tools/ (via rmarkdown)  quarto 1.5.45 @ C:\\PROGRA~1\\Quarto\\bin\\quarto.exe  ─ Packages ───────────────────────────────────────────────────────────────────  package \* version date (UTC) lib source  sessioninfo \* 1.2.2 2021-12-06 [1] CRAN (R 4.4.2)   [1] C:/DATA/R.Apps/R-4.4.1-win/library  ────────────────────────────────────────────────────────────────────────────── |

# 1. Pre-requisites

To start using the toolkit for your *fast-track Delphi* project, you will need to:

* install RStudio and R - see Appendix A in [Hands-On Programming with R](https://jjallaire.github.io/hopr/a1-starting.html) by Garrett Grolemund
* get some packages - see below
* create a [**REDCap**](https://projectredcap.org/) project and the token to access it through the R project - see [Chapter 4](#sec-instructions-for-redcap)

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| Tip |
| We strongly suggest you also go through [Chapter 2](#sec-understand-type-of-questions) to understand the structure of the types of questions and how they are considered by the code for analysis and reporting. The demo we offer with this user guide (see [Chapter 3](#sec-demo)) is also useful to explore before starting your own project. |

## 1.1 Get some packages

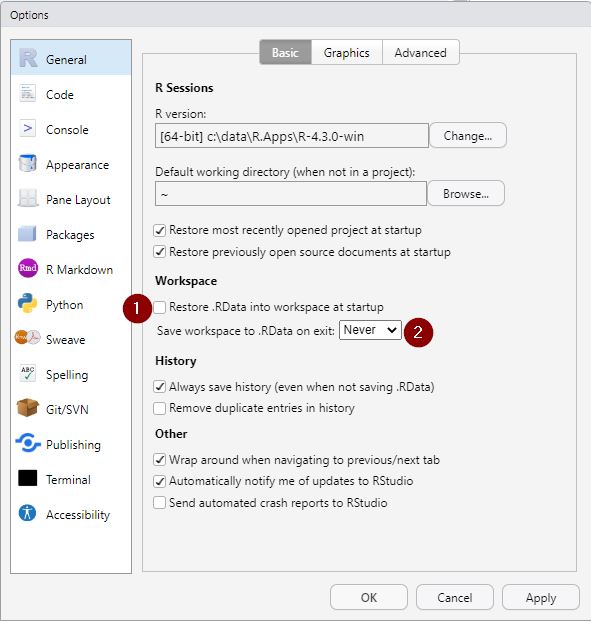
You will need to run the following *chunks (lines of executable code)*

* ☐ Install pacman unless you already have it : simpler to call libraries and keep them up-to-date
* ## install it if not already there  
  if (!require("pacman")) install.packages("pacman")
* ☐ Load the following packages with pacman::p\_load (it will 1. install package if not installed and keep it up-to-date, 2. call the library)
* pacman::p\_load(  
   bookdown,  
   crayon,  
   data.table,  
   flextable,  
   formattable,  
   fs,  
   ftExtra,  
   ggplot2,  
   haven,  
   here,  
   magrittr,  
   officedown,  
   patchwork,  
   purrr,  
   REDCapR,  
   sjlabelled,  
   sjmisc,  
   sjPlot,  
   stringr,  
   tidyverse,  
   writexl)  
    
  ## install.packages("remotes") ## If it's not already installed.  
  remotes::install\_github("OuhscBbmc/OuhscMunge")
* ☐ Install [fast-track Delphi: code only](https://github.com/Unisante/delphi-fast-track)
* Download as a zip file (click on green button Code), and unzip locally  
   or  
  remotes::install\_github("Unisante/delphi-fast-track")

## 1.2 Our preferred options for RStudio

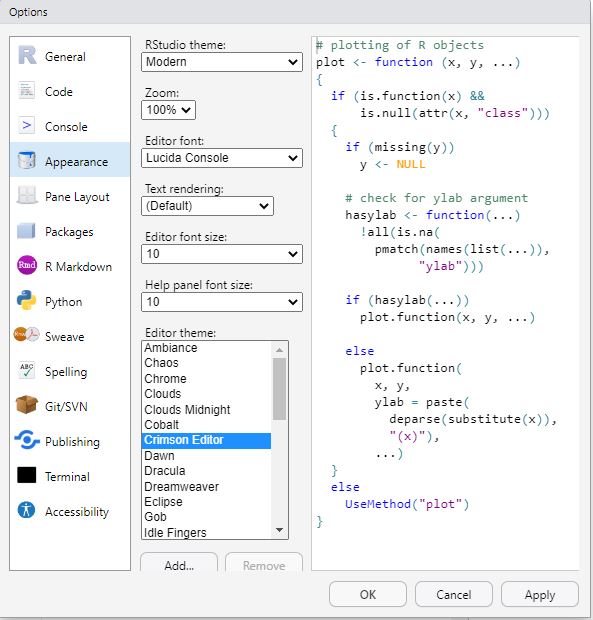
### 1.2.1 Workspace

* Never restore or save the RData into the workspace



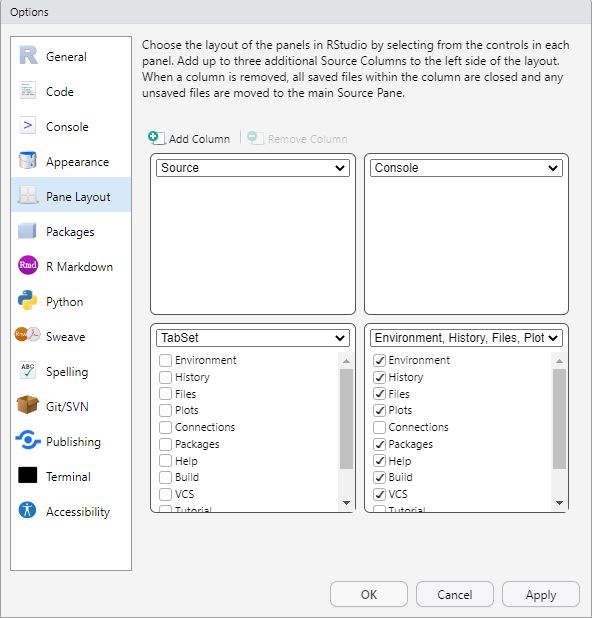
### 1.2.2 Appearance

* We like *Lucida console* and *Crimson editor*



### 1.2.3 Pane layout

* We like to have more space for the source to the left



# 2. Types of questions

There are three types of questions in a *fast-track Delphi* process. Their structure and implications for the analysis and reporting are described below. Round 2 (dft2) will include all three types of question, while round 3 (dft3) should in principle include only type 1 questions.

Detailed rationale for the methodology can be found in [publications](#sec-publications).

We suggest you read the following paragraphs to understand the outputs that will be produced for each type of question, before going further in your project.

## 2.1 Type 1 question

They are Likert questions. Experts express their opinion by rating their level of agreement with an affirmative statement on a scale from 1 (complete disagreement) to 9 (complete agreement).

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| Figure 2.1: Example of a type 1 question (statement #3) as structured in the REDCap e-questionnaire (in French) - [Chapter 4](#sec-instructions-for-redcap) will guide you through the creation of this type of question within your REDCap project. |

* For each statement, the code produces a statistical (median, interquartile [IQR] and minimum-maximum ranges) and a graphical (barplot and boxplot) summary. The number of respondents is also indicated, with percent of total respondents.
* A green tick indicates that an agreement and/or a consensus was reached at the group level (see thresholds in [Section 2.5](#sec-agreement-and-consensus-thresholds)).
* For individualised result reports, the expert’s answer is displayed in digits (column ‘your answers’) and on the graphical summary of group response distribution.
* All type 1 questions of a given section are summarised in one unique table. Below is an example (in French) of the output for one statement of one individualised result report.

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| --- |
| Figure 2.2: Output examplar for a type 1 question - caption from an individualised result report |

## 2.2 Type 2 question

They are multiple choice questions with one possible response, that aim at clarifying experts’ topical propositions and orienting future statements. “No opinion” is always proposed as a choice option.

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| Figure 2.3: Example of a type 2 question (statement #14) as structured in the REDCap e-questionnaire (in French) - [Chapter 4](#sec-instructions-for-redcap) will guide you through the creation of this type of question within your REDCap project. |

* For each question, the code produces a statistical (number of responses for each option with percent of total respondents) and graphical display of group responses.
* A green tick indicates that an agreement was reached for one or several particular answer options (see thresholds in [Section 2.5](#sec-agreement-and-consensus-thresholds)).
* Answer options are automatically sorted by descending frequency of responses (“No opinion” always appearing at the bottom).
* For individualised result reports, the expert’s answer is indicated by a red cross (column ‘your answer’).
* Each type 2 question is summarised in a separate table. Below is an example (in French) of the output for one type 2 question of one individualised result report.

|  |
| --- |
| Figure 2.4: Output examplar for a type 2 question - caption from an individualised result report |

## 2.3 Type 3 question

They are multiple choice questions with up to three answer options, that aim at precising experts’ topical propositions and orienting future statements. “No opinion” is always proposed as a choice option.

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| Figure 2.5: Example of a type 3 question (statement #2) as structured in the REDCap e-questionnaire (in French) - [Chapter 4](#sec-instructions-for-redcap) will guide you through the creation of this type of question within your REDCap project. |

* For each question, the code produces a statistical (number of responses for each option with percent of total respondents) and graphical display of group responses.
* A green tick indicates that an agreement was reached for one or several particular answer options (see thresholds in [Section 2.5](#sec-agreement-and-consensus-thresholds)). Answer options are automatically sorted by descending frequency of responses (“No opinion” always appearing at the bottom).
* For individualised result reports, the expert’s answers are indicated by red crosses (column ‘your answers’).
* Each type 3 question is summarised in a particular table. Below is an example (in French) of the output for one type 3 question of one individualised result report.

|  |
| --- |
| Figure 2.6: Output examplar for a type 3 question - caption from an individualised result report |

## 2.4 Comments

Participants can leave comments after each question (for all types). They are very useful to prepare statement reformulations for round 3 and refine key messages at the end of round 3.

## 2.5 Agreement and consensus thresholds

We defined the following thresholds based on the literature and a pragmatic approach. These thresholds can be modified in 000\_parameters.R.

* For type 1 questions
  + Agreement is defined by the center value of the data (median), and is considered reached when the median is ≥ 7 out of 10 (≤ 3 out of 10 for disagreement considered reached)
  + Consensus is defined by the dispersion of the data (interquartile range, IQR), and is considered reached when the IQR does not exceed 3 scale points.
* For type 2 and 3 questions
  + Agreement is reached when the answer has been selected by ≥ 66% of the respondents.

## 2.6 Conventions

* Comments in the R code are preceded by ##
* Filenames and paths are in typewriter style
* Packages are in **bold** : **data.table**
* Functions are followed by a () : fs::dir\_tree()
* ☐ . Run this code … : actions you need to take to prepare your own project are preceded by a ticking box (not interactive)

The table below summarizes the conventions used in the names of tables and variables.

| Word used | Example as part of name | Example inside a word document | What it means |
| --- | --- | --- | --- |
| dt | dt\_ | - | a data.table |
| current\_round | dft2\_ , dft3\_ | - | round 2 or round 3 |
| section | \_a\_ | Section A | sections correspond to different aspects of the topic |
| statement | \_s1\_ | Statement 1 | statement followed by its number |
| type | \_type1 | type 1 | type of question |

|  |
| --- |
| Tip |
| The easiest way to understand the process and see the output is to download the [demo](https://github.com/Unisante/delphi-ft-demo) and explore it (see [Chapter 3](#sec-demo)). |

# 3. Demo

We provide a demonstration with

* the anonymised dataset and metadata from our pilot study (done in french) (Velarde Crézé et al. 2023)
* the complete code (\*.R and \*.Rmd), slightly modified (the codes retrieving real non-anonymized data from REDCap and updating introductive texts are not run)
* the final output, so you can go through the reports generated by the code

You can run this demonstration on your machine to make sure it works before starting your own project.

|  |  |
| --- | --- |
|  | Sometimes the code might not run smoothly if one of the packages (or R) has been updated.  Should this occur, you can :   * re-run all the code from the beginning so the variables and .RData files have the most recent format * look on [Stackoverflow](https://www.stackoverflow.com) if someone had the same problem * try to narrow down what causes the problem and ask a question yourself with a reproducible example (reprex) on [Stackoverflow](https://www.stackoverflow.com) * wait a week or two so the problem is spotted and hope a solution was found |

## 3.1 Download the demo

Our [fast-track Delphi: code with demo data and results](https://github.com/Unisante/delphi-fast-track-demo) is available on GitHub.

## 3.2 Look at the reports

In ./output/reports/, you will find the reports which are **editable word documents**:

* one generic report and one individualized report per expert - for the second round (dft2)
* one generic report and one individualized report per expert - for the third round (dft3)
* an overall executive summary synthesizing results from the second and third rounds

## 3.3 Understand the structure

### 3.3.1 Folders content

* analysis
  + **Rmd files**: one common for the introductory text for the method section and the others in subfolders for each round (dft2, dft3) and for the overall report
  + **docx templates**: one in each subfolder
* code : **R files** that are common to both rounds and others in two subfolders for each round (dft2, dft3) - the numbers indicate the order in which they are run
* data: data and metadata **RData files** for the raw data and in subfolders for each round (dft2, dft3)
* output: subfolders checks, png, RData, reports. **Final reports** in an editable word format are located in the subfolder reports (generic and individualized result reports).
* texts\_intro: editable **docx** with separate introductory texts that will be inserted into the reports

### 3.3.2 Files to run

* 00\_run\_ME\_once\_to\_create\_structure.R: not needed for demo (the folder structure of the project is already created).

The following files at root can be run one at a time:

* 0\_run\_ME\_dft2\_demo.R
* 0\_run\_ME\_dft3\_demo.R
* 0\_run\_ME\_overall\_demo.R

They will produce :

* intermediate tables saved in ./output/RData/ and ./output/checks/
* miniplots saved in ./output/png/
* word reports saved in ./output/reports/

## 3.4 Discover the functions

We chose to keep the functions used in these analyses in a R file because it is easier to toy with.

We strongly recommend that you become familiar with the functions developed for this analysis in code ./code/00\_functions.R. This code will also run each time ./code/000\_parameters.R is sourced.

# 4. Instructions for REDCap

[**REDCap**](https://projectredcap.org/) is a secure online survey management platform.

For the *fast-track Delphi* process, both e-questionnaires of rounds 2 and 3 are administered with REDCap using two separate ‘REDCap projects’. Data are collected and stored within the corresponding REDCap project.

The structure of both e-questionnaires in [**REDCap**](https://projectredcap.org/) should follow a particular “skeleton” - explanations provided below - to ensure comprehensive and automatic reading of the data by the R code. Be sure you have read and understood [Chapter 2](#sec-understand-type-of-questions) explaining the various types of question that are used in a *fast-track Delphi* process.

The steps below will guide you through the creation of your two REDCap projects (one for round 2 and a separate one for round 3).

|  |
| --- |
| Tip |
| The idea is for you to familiarize with the structure and parameters of the REDCap project **ahead of conducting the *fast-track Delphi* process itself**, so that you only have to feed the project with your statement *texts* during rush periods.  **To this end, we strongly suggest creating both REDCap projects in advance**. |

## 4.1 Create the “skeleton” of your REDCap projects

We created a *fast-track Delphi* REDCap “skeleton” projects including all survey parameters and structured example items for type 1, 2 and 3 questions and saved as \*.xml, for round 2 and round 3.

Once you have downloaded the [Fast-track Delphi : code only](https://github.com/Unisante/delphi-fast-track) (see [Chapter 5](#sec-start-your-project)), you will find these \*.xml files in the folder delphi\_ft/\_xml\_for\_redcap/.

* ☐ Create two new separate REDCap projects on your institutional REDCap platform by importing these \*.xml files into blank projects - talk with your REDCAp Admin if necessary. You should do this twice (once for each round)
* ☐ Give a name to your projects: *DelphiFT project\_name round 2* and *DelphiFT project\_name round 3*, respectively (replace *project\_name* by your project name)
* ☐ Within each of these REDCap projects, manage the access rights to suit your team’s needs by modifying access parameters on the ‘Users Rights’ Menu (left side on your REDCap project page)

You should then **familiarize with the proposed structure**, which is the following:

* For round 2:
  + One foreword section containing 6 fields aiming at describing your panel of experts (the email field is MANDATORY - do not remove or modify it!)
  + One ‘preamble’ section (Z) containing **one type 1 question** (4 fields), **one type 2 question** (2 fields) and **one type 3 question** (6 fields)
  + Three sections (A, B and C) containing each **two questions of each type**
* For round 3:
  + One foreword section containing 1 field aiming at collecting experts’ email (MANDATORY - do not remove it!)
  + One ‘preamble’ section (Z) containing **three type 1 question**
  + Three sections (A, B and C) containing each **three type 1 question**

This structure is of course subject to modifications to suit your needs in due time, i.e., when you have created the statement content of the e-questionnaire based on the results of the previous round (see the start of [Chapter 6](#sec-round-2) and [Chapter 7](#sec-round-3) for REDCap management during rush periods of rounds 2 and 3, respectively).

|  |
| --- |
| Tip |
| We strongly suggest you try duplicating any type 1, 2 and 3 question in your REDCap project, and test the e-questionnaire, so you are prepared doing it efficiently in a rush period.  When duplicating a question, **you must duplicate ALL fields that belong to this question - and update their variable name and branching logic accordingly**:   * A type 1 question contains 4 fields (one matrix field, one simple field, one embedding field, and one field for comments) * A type 2 question contains 2 fields (one simple field, and one field for comments) * A type 3 question contains 6 fields (two simple fields, one embedding field, two fields for message parameters, and one field for comments) |

## 4.2 Token to access your REDCap projects

The R code can automatically access the data stored within the corresponding REDCap project through a *token (a string of letters and digits that functions as a unique identifier for your project).*

The steps below will allow the codes to automatically retrieve your personal tokens corresponding to your REDCap project, for each of the two rounds (dft2 and dft3), whilst avoiding sharing them.

* ☐ Obtain your tokens from the ‘API’ Menu in [**REDCap**](https://projectredcap.org/) - talk with your REDCAp Admin if necessary
* ☐ Open *token\_delphi\_ft\_this\_project.R.example* and save it as ‘token\_delphi\_ft\_this\_project.R’
* ☐ Update the lines below with your details from the ‘API’ Menu in REDCap and save it again:
* redcap\_uri <- "https://XXXXXXXXX/api/"   
  token\_dft2 <- "YYYYYYYYYYYYYYYY"  
  token\_dft3 <- "ZZZZZZZZZZZZZZZZ"

|  |
| --- |
| Note |
| . ‘token\_delphi\_ft\_this\_project.R’ has been added to *.gitgnore* to avoid transmitting the data to a git depot  . if you use other means to share your work, alway delete the files containing your details to login into your redcap server |

# 5. Start your project

## 5.1 Pre-requisites

* ☐ To start your own project, download the [fast-track Delphi: code only](https://github.com/Unisante/delphi-fast-track) available on GitHub.
* ☐ Make sure you have done the steps presented in [Chapter 1](#sec-pre-requisites) (install RStudio and R + get some packages)
* ☐ Make sure you went through and understood [Chapter 2](#sec-understand-type-of-questions)
* ☐ Make sure you have prepared the structure of your projects in [**REDCap**](https://projectredcap.org/) and got a token to access them according to the instructions in [Chapter 4](#sec-instructions-for-redcap)

## 5.2 Understand the structure

You are now ready to start your own project. Below you will find the detail of the structure - folders, subfolders and files - when you start your project, and what will be added by the end. The demo you have been through in [Chapter 3](#sec-demo) shows a project when it is finished.

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| --- |
| Tip |
| You can use [fs::dir\_tree()](https://fs.r-lib.org/reference/dir_tree.html) to see the structure at any time. |

### 5.2.1 At the begining

When you start your project (i.e., when downloading the [fast-track Delphi: code only](https://github.com/Unisante/delphi-fast-track) on GitHub), you will have the following structure:

├── 000\_READ\_ME\_first.md  
├── 00\_run\_ME\_once\_to\_create\_structure.R  
├── 0\_run\_ME\_dft2.R  
├── 0\_run\_ME\_dft3.R  
├── 0\_run\_ME\_overall.R  
├── \_xml\_for\_redcap  
│ ├── DelphiFTTemplateRound\_2.REDCap.xml  
│ ├── DelphiFTTemplateRound\_3.REDCap.xml  
├── analysis  
│ ├── 00\_child\_intro\_method.Rmd  
│ ├── dft2  
│ │ ├── dft2\_child\_section.Rmd  
│ │ ├── dft2\_report\_generic.Rmd  
│ │ ├── dft2\_report\_per\_participant.Rmd  
│ │ └── template-bookdown.docx  
│ ├── dft3  
│ │ ├── dft3\_child\_section.Rmd  
│ │ ├── dft3\_report\_generic.Rmd  
│ │ ├── dft3\_report\_per\_participant.Rmd  
│ │ └── template-bookdown.docx  
│ └── overall  
│ ├── delphiFT\_Overall\_FigureFlow.pptx  
│ ├── ExecutiveSummary\_figure\_Target-Consensus.png  
│ ├── ExecutiveSummary\_figure\_Target-NoConsensus.png  
│ ├── overall\_executive\_summary.Rmd  
│ └── template\_exec\_summary\_bookdown.docx  
├── code  
│ ├── 000\_parameters.R  
│ ├── 00\_functions.R  
│ ├── 00\_update\_texts\_intro.R  
│ ├── 03a\_create\_flextable\_results\_type\_1\_generic.R  
│ ├── 03b\_create\_flextable\_results\_type\_2\_3\_generic.R  
│ ├── 04a\_create\_flextable\_results\_type\_1\_participants.R  
│ ├── 04b\_create\_flextable\_results\_type\_2\_3\_participants.R  
│ ├── 06\_prepare\_tables\_combined\_round\_2\_3.R  
│ ├── dft2  
│ │ ├── 01a\_dft2\_update\_data\_with\_REDCapR.R  
│ │ ├── 01b\_dft2\_recode\_data.R  
│ │ ├── 01c\_dft2\_define\_cols.R  
│ │ ├── 02a\_dft2\_prepare\_tables\_without\_participant\_id.R  
│ │ ├── 02b\_dft2\_prepare\_tables\_participants.R  
│ │ └── 05\_dft2\_to\_render\_individual\_reports.R  
│ └── dft3  
│ ├── 01a\_dft3\_update\_data\_with\_REDCapR.R  
│ ├── 01b\_dft3\_recode\_data.R  
│ ├── 01c\_dft3\_define\_cols.R  
│ ├── 02a\_dft3\_prepare\_tables\_without\_participant\_id.R  
│ ├── 02b\_dft3\_prepare\_tables\_participants.R  
│ └── 05\_dft3\_to\_render\_individual\_reports.R  
├── texts\_intro  
│ ├── .. several \*.docx files  
├── token\_delphi\_ft\_this\_project.R.example  
└── delphi\_ft.Rproj

### 5.2.2 At the end

The following will appear during the analysis and report production.

├── token\_delphi\_ft\_this\_project.R  
├── data  
│ ├── dft2  
│ │ ├── dft2\_data\_clean.RData  
│ │ ├── dft2\_lookup\_final.RData  
│ │ └── dft2\_lookup\_value\_labels\_final.RData  
│ ├── dft3  
│ │ ├── dft3\_data\_clean.RData  
│ │ └── dft3\_lookup\_final.RData  
│ └── redcap\_data\_raw  
│ ├── dft2\_data\_redcapr\_raw.RData  
│ ├── dft2\_metadata.RData  
│ ├── dft3\_data\_redcapr\_raw.RData  
│ └── dft3\_metadata.RData  
├── output  
│ ├── checks  
│ │ ├── .. several \*.xlsx files  
│ ├── png  
│ │ ├── .. several \*.png files  
│ ├── RData  
│ │ ├── dft2\_dt\_comments\_m.RData  
│ │ ├── dft2\_type0\_zz1.RData  
│ │ ├── dft2\_type1\_zz\_combined.RData  
│ │ ├── dft2\_type2\_zz1.RData  
│ │ ├── dft2\_type3\_zz1.RData  
│ │ ├── dft3\_dt\_comments\_m.RData  
│ │ ├── dft3\_type1\_zz\_combined.RData  
│ │ └── type1\_zz\_combined\_round\_2\_3.RData  
│ └── reports  
│ ├── dft2  
│ │ ├── dft2\_report\_generic\_YYYY-MM-DD.docx  
│ │ └── report\_by\_participant  
│ │ ├── dft2\_report\_participant\_1\_YYYY-MM-DD.docx  
│ │ ├── ...  
│ ├── dft3  
│ │ ├── dft3\_report\_generic\_YYYY-MM-DD.docx  
│ │ └── report\_by\_participant  
│ │ ├── dft3\_report\_participant\_1\_YYYY-MM-DD.docx  
│ │ ├── ...  
│ └── overall  
│ └── dft\_overall\_executive\_summary\_YYYY-MM-DD.docx  
.  
.  
.

## 5.3 Create the structure of your project

* ☐ Run 00\_run\_ME\_once\_to\_create\_structure.R

This will create the predefined set of folders and subfolders - detailed above in [Section 5.2](#sec-understand-the-structure-start) - within your main project folder.

|  |
| --- |
| Warning |
| We strongly advise keeping this predefined structure as it is. If you still choose to modify it, you will need to revise every path in the \*.R and \*.Rmd files. |

## 5.4 Update parameters

* ☐ Open ./code/000\_parameters.R and update with your topical inputs, as necessary

## 5.5 Update the word templates

This project uses MS Word templates in order to build the generic and individualized reports. The autonumbering will be created by [bookdown](https://pkgs.rstudio.com/bookdown/).

* ☐ Update the templates to suit your needs in each subfolder :
  + ./analysis/dft2/template-bookdown.docx
  + ./analysis/dft3/template-bookdown.docx
  + ./analysis/doverall/template\_exec\_summary\_bookdown.docx

Please refer to the [Officeverse manual](https://ardata-fr.github.io/officeverse/) to see how to do it.

## 5.6 Update introductory texts

These texts are word documents with one or two paragraphs, sometimes images that will be inserted at the beginning of the reports. They will be updated in several steps, once some of the results are available.

* ☐ Prepare the word documents in advance to gain time

|  |  |
| --- | --- |
|  | * Do not leave a blank line at the beginning of the text, nor at the end * Headers are not needed in these texts as they will be provided in Rmd files |

* ☐ Store them on the server in the folder defined in ./code/000\_parameters.R (called path\_texts\_intro\_server).
* ☐ Run ./code/00\_update\_texts\_intro.R

Congratulations: **you are now ready** to conduct round 1 (expert meeting following an adapted Nominal Group Technique (NGT) procedure - not detailed in this userguide) and round 2 with your panel of experts!

# 6. Round 2

## 6.1 E-questionnaire management through REDCap

Round 1 (*experts meeting following an adapted Nominal Group Technique procedure - not detailed in this user guide, see* [*publications*](#sec-publications) *for more details*) is over. Experts have generated and prioritized thematic proposals that you have reformulated into statements (type 1, 2 and 3 questions - see [Chapter 2](#sec-understand-type-of-questions)).

The following steps should be done in 1 day:

* ☐ Within your round 2 REDCap project: **replace all “xxx” with the texts of your actual statements and answer options**. Duplicate type 1, 2 and/or 3 questions’ “skeleton” based on your needs, i.e., the number of sections and types of questions per section that you wish to include in this e-questionnaire
* ☐ Test the e-questionnaire to verify comprehensiveness of the content and the absence of technical bugs
* ☐ Move this round 2 REDCap project into production mode - talk with your REDCap Admin if necessary
* ☐ Send the hyperlink to experts (participants) with a deadline for e-questionnaire completion

You can now relax during 3-4 days, until the deadline is over.

|  |
| --- |
| Tip |
| Data collection can be observed in real time by accessing the ‘Dashboard’ Menu in your round 2 REDCap project. When getting close to the deadline, remember to send a personalized email to any experts who has not yet completed the e-questionnaire. |

## 6.2 0\_run\_ME\_dft2.R - Overview of steps

Once data collection for round 2 is over, you can open 0\_run\_ME\_dft2.R. It will show you the order of files to update and run. It will upload, process and analyse the data and create reports.

## 6.3 Update data

* ☐ Run ./code/dft2/01a\_dft2\_update\_data\_with\_REDCapR.R

This code will connect to the corresponding [**REDCap**](https://projectredcap.org/) project using the token, downloads the raw data and metadata from the project, and save them as \*.RData files. It also creates \*.xlsx tables by type of question (1, 2 and 3, see [Chapter 2](#sec-understand-type-of-questions)) with the raw data, which can be used for quick checks, if necessary.

### 6.3.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./data/redcap\_data\_raw/ | dft2\_metadata.RData | Raw metadata |
| ./data/redcap\_data\_raw/ | dft2\_data\_redcapr\_raw.RData | Raw data |

## 6.4 Recode data

* ☐ Update as required and run ./code/dft2/01b\_dft2\_recode\_data.R

This code will process the raw data and the metadata downloaded in [Section 6.3](#sec-update-data-round2), in order to create the “clean” data and metadata tables. In particular, it will:

* correct labeling errors, typos, etc.
* simplify labeling
* define the lists of variables by type of questions (1, 2, 3)
* do a conditional deduplication (in case one or several participants have filled in several REDCap records per person => keep the *latest chosen answer option* and *all comments*)
* save clean data and metadata in RData format

|  |
| --- |
| Figure 6.1: dft2\_a\_s6\_type1.png (statement 6 in section A of round 2) |

* create visuals (\*.png) for all type 1 questions only, showing the distribution of answers on a 1 to 9 scale and a boxplot - see [Figure 6.1](#fig-dft2-type1)

### 6.4.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./data/dft2/ | dft2\_data\_clean.RData | Clean data |
| ./data/dft2/ | dft2\_lookup\_final.RData | Clean lookup table (metadata) |
| ./data/dft2/ | dft2\_lookup\_value\_labels\_final.RData | Clean lookup table (metadata) with value labels for type 1 and 2 questions |
| ./output/check/ | \*.xlsx | Various xlsx files that can be used for checks or sharing |
| ./output/png/ | dft2\_\*\_s\*\_type1.png | Visuals for all type 1 questions |

## 6.5 Prepare tables without participant id

* ☐ Run ./code/dft2/02a\_dft2\_prepare\_tables\_without\_participant\_id.R

This code will analyse the “clean” data (generated in [Section 6.4](#sec-recode-data-round2)) to create the group result tables (= statistical and graphical summaries).

It automatically calls code ./code/dft2/01c\_dft2\_define\_cols.R.

It also creates and saves in \*.xlsx format tables containing only the “no opinion” responses, allowing a quick check if necessary.

### 6.5.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./output/RData/ | dft2\_type0\_zz1.RData | Table with characteristics of participants |
| ./output/RData/ | dft2\_type1\_zz\_combined.RData | Table with results of all type 1 questions |
| ./output/RData/ | dft2\_type2\_zz1.RData | Table with results of all type 2 questions |
| ./output/RData/ | dft2\_type3\_zz1.RData | Table with results of all type 3 questions |
| ./output/RData/ | dft2\_dt\_comments\_m.RData | Table with all comments |
| ./output/check/ | dft2\_type\*\_zz0\_no\_opinion.xlsx | Quick check table of ‘no opinion’ responses for type \* questions |

## 6.6 Update introductory texts

* ☐ Update the content of your introductory texts (\*.docx) if needed, as indicated in the [Section 5.6](#sec-update-texts-introduction).
* ☐ Run ./code/00\_update\_texts\_intro.R

This code updates the local directory of texts used in the introduction of the report sections (from the available and up-to-date directory on the server).

## 6.7 Publish the generic report

The number of sections and the number of each type of questions within these sections will vary between projects.

The list of sections needs to be defined manually in 000\_parameters.R.

* ☐ Publish the generic report by running the lines below in 0\_run\_ME\_dft2.R
* ### . publish Rmd ----  
  ### .. dft2\_report\_generic.Rmd ----  
  input <- "analysis/dft2/dft2\_report\_generic.Rmd"  
    
  output\_file <- here::here('output', 'reports', 'dft2',  
   stringr::str\_glue("dft2\_report\_generic\_{Sys.Date()}.docx"))  
    
  rmarkdown::render(  
   input = input,  
   output\_file = output\_file)

This code will create the word document (“generic report”) by inserting the introductory texts (updated in [Section 6.6](#sec-update-introductory-texts-round2)) and the results tables (created in [Section 6.5](#X66ad5386239565e6555c6e6464137dd66b4583d)), based on a reference word template.

It automatically calls ./code/dft2/01c\_dft2\_define\_cols.R and ./analysis/00\_child\_intro\_method.Rmd. Then, for each section, it calls ./analysis/dft2/dft2\_child\_section.Rmd, which will create tables for each type of questions that are in the section (conditional *for loop*), by running two codes:

* ./code/03a\_create\_flextable\_results\_type\_1\_generic.R : creates the result table for type 1 statements in the section and for their comments
* ./code/03b\_create\_flextable\_results\_type\_2\_3\_generic.R : creates the result tables for type 2 and 3 statements in the section and for their comments

### 6.7.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./output/reports/dft2 | dft2\_report\_generic\_date\_YYYY-MM-DD.docx | Generic report with date |

## 6.8 Publish all individualized reports

* ☐ Publish individualized reports - one for each respondent of round 2 - by running the lines below in 0\_run\_ME\_dft2.R
* ### .. 05\_dft2\_to\_render\_individual\_reports.R ------------------------------  
  ### TAKES time ... have a coffee, a walk, a nice chat with someone ...  
  source(here::here('code', 'dft2', '05\_dft2\_to\_render\_individual\_reports.R'),  
   encoding = 'UTF-8')

This code will create the word document for each expert participant (“individualized report”), based on a word template, by inserting the email of the expert, the introductory texts (updated in [Section 6.6](#sec-update-introductory-texts-round2)), as well as the group result tables with individual answers for each statement.

|  |
| --- |
| Figure 6.2: dft2\_a\_s6\_type1\_participantX.png (statement 6 in section A of round 2 - response of participant X is in red) |

The code ./analysis/dft2/dft2\_report\_per\_participant.Rmd (automatically called within ./code/dft2/05\_dft2\_to\_render\_individual\_reports.R) uses an iterative loop to create the individualized result report for each participant by calling automatically:

* ./code/dft2/01c\_dft2\_define\_cols.R and
* ./code/dft2/02b\_dft2\_prepare\_tables\_participants.R : adds results of the participant to the generic table, and includes plots like [Figure 6.2](#fig-dft2-type1-participantX).

It will then call ./analysis/00\_child\_intro\_method.Rmd as well as, for each section, ./analysis/dft2/dft2\_child\_section.Rmd, which will create tables for each type of questions that are in the section (conditional *for loop*), by running two codes:

* ./code/04a\_create\_flextable\_results\_type\_1\_participants.R : creates the result table for type 1 statements with individual answers in the section and for their comments
* ./code/04b\_create\_flextable\_results\_type\_2\_3\_participants.R : creates the result table for type 2 and 3 statements with individual answers in the section and for their comments

### 6.8.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| /output/reports/dft2/report\_by\_participant/ | dft2\_report\_participant\_X\_YYYY-MM-DD.docx | Individualized reports (one per participant) with date |

Congratulations: **you are now ready** to conduct round 3!

# 7. Round 3

## 7.1 E-questionnaire management through REDCap

Round 2 is over. You have now rephrased, added and/or fused statements from round 2 into new ones and are ready to start round 3.

|  |
| --- |
| Note |
| There should be only type 1 questions in this round. The code is therefore simpler and run faster than in round 2. |

The following steps should be done in 1 day:

* ☐ Within your round 3 REDCap project: **replace all “xxx” with the texts of your actual statements**. Each statement header should also indicate reference(s) to the question(s) in round 2 from which it was derived. Duplicate type 1 questions’ “skeleton” based on your needs, i.e., the number of questions per section that you wish to include in this e-questionnaire
* ☐ Test the e-questionnaire to verify comprehensiveness of the content and the absence of technical bugs
* ☐ Move this round 3 REDCap project into production mode - talk with your REDCap Admin if necessary
* ☐ Send the hyperlink to experts (participants) with a deadline for e-questionnaire completion ; together with this hyperlink, send their individualized result report from round 2 (output of [Section 6.8.1](#X13b59c9886ae91d37ca8376e3405d2a8177edb3))

You can now relax during 3-4 days, until the deadline is over.

|  |
| --- |
| Tip |
| Data collection can be observed in real time by accessing the ‘Dashboard’ Menu in [**REDCap**](https://projectredcap.org/). When getting close to the deadline, remember to send a personalized email to any experts who has not yet completed the e-questionnaire. |

## 7.2 0\_run\_ME\_dft3.R - Overview of steps

Once data collection for round 3 is over, you can open 0\_run\_ME\_dft3.R. It will show you the order of files to update and run. It will upload, process and analyse the data and create reports.

## 7.3 Update data

* ☐ Run ./code/dft3/01a\_dft3\_update\_data\_with\_REDCapR.R

This code will connect to the corresponding [**REDCap**](https://projectredcap.org/) project using the token, downloads the raw data and metadata from the project, and save them as \*.RData files. It also creates one \*.xlsx table with the raw data, which can be used for quick checks.

### 7.3.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./data/redcap\_data\_raw/ | dft3\_metadata.RData | Raw metadata |
| ./data/redcap\_data\_raw/ | dft3\_data\_redcapr\_raw.RData | Raw data |

## 7.4 Recode data

* ☐ Update as required and run ./code/dft3/01b\_dft3\_recode\_data.R

This code will process the raw data and the metadata downloaded in [Section 7.3](#sec-update-data-round3), in order to create the “clean” data and metadata tables. In particular, it will:

* correct labeling errors, typos, etc.
* simplify labeling
* define the lists of variables by type (1)
* do a conditional deduplication (in case one or several participants have filled in several REDCap records per person -> keep the *latest answer choice* and *all comments*)
* save clean data and metadata in RData format

|  |
| --- |
| Figure 7.1: dft3\_z\_s4\_type1.png (for the statement 4 in preamble of round 3) |

* create visuals (\*.png) for all type 1 questions, showing the distribution of answers on a 1 to 9 scale and a boxplot - see [Figure 7.1](#fig-dft3-type1)

### 7.4.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./data/dft3/ | dft3\_data\_clean.RData | Clean data |
| ./data/dft3/ | dft3\_lookup\_final.RData | Clean lookup table (metadata) |
| ./output/check/ | \*.xlsx | Various xlsx files that can be used for checks or sharing |
| ./output/png/ | dft3\_\*\_s\*\_type1.png | Visuals for all type 1 questions |

## 7.5 Prepare tables without participant id

* ☐ Run ./code/dft3/02a\_dft3\_prepare\_tables\_without\_participant\_id.R

This code will analyse the “clean” data (generated in [Section 7.4](#sec-recode-data-round3)) to create the group result tables (= statistical and graphical summaries).

It automatically calls code ./code/dft3/01c\_dft3\_define\_cols.R.

It also creates and saves in \*.xlsx format the table containing only the “no opinion” responses, allowing a quick check if necessary.

### 7.5.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./output/RData/ | dft3\_type1\_zz\_combined.RData | Table with results of all type 1 questions |
| ./output/RData/ | dft3\_dt\_comments\_m.RData | Table with all comments |
| ./output/check/ | dft3\_type1\_zz0\_no\_opinion.xlsx | Quick check table of ‘no opinion’ responses |

## 7.6 Update introductory texts

* ☐ Update the content of your introductory texts (\*.docx) if needed, as indicated in the [Section 5.6](#sec-update-texts-introduction).
* ☐ Run ./code/00\_update\_texts\_intro.R

This code updates the local directory of texts used in the introduction of the report sections (from the available and up-to-date directory on the server).

## 7.7 Publish the generic report

The number of sections and the number of questions (all type 1) within these sections will vary between projects.

The list of sections needs to be defined manually in 000\_parameters.R.

* ☐ Publish the generic report by running the lines below in 0\_run\_ME\_dft3.R
* ### . publish Rmd ----  
  ### .. dft3\_report\_generic.Rmd ----  
  input <- "analysis/dft3/dft3\_report\_generic.Rmd"  
    
  output\_file <- here::here('output', 'reports', 'dft3',  
   stringr::str\_glue("dft3\_report\_generic\_{Sys.Date()}.docx"))  
    
  rmarkdown::render(  
   input = input,  
   output\_file = output\_file)

This code will create the word document (“generic report”) inserting the introductory texts (updated in [Section 7.6](#sec-update-introductory-texts-round3)) and the results tables (created in [Section 7.5](#X97de9921e500419e035c48d5206a67a9ffe6b7e)), based on a reference word template.

It automatically calls ./code/dft3/01c\_dft3\_define\_cols.R. and ./analysis/00\_child\_intro\_method.Rmd. Then, for each section, it calls ./analysis/dft3/dft3\_child\_section.Rmd, which will create tables for all questions (type 1) that are in the section (conditional *for loop*), by running one code:

* ./code/03a\_create\_flextable\_results\_type\_1\_generic.R : creates the result table for type 1 statements in the section and for their comments

### 7.7.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./output/reports/dft3 | dft3\_report\_generic\_date\_YYYY-MM-DD.docx | Generic report with date |

## 7.8 Publish all individualized reports

* ☐ Publish individualized reports - one for each respondent of round 3 - by running the lines below in 0\_run\_ME\_dft3.R
* ### .. 05\_dft3\_to\_render\_individual\_reports.R ------------------------------  
  ### TAKES time ... have a coffee, a walk, a nice chat with someone ...  
  source(here::here('code', 'dft3', '05\_dft3\_to\_render\_individual\_reports.R'),  
   encoding = 'UTF-8')

This code will create the word document for each participant (“individualized report”), based on a word template, by inserting the email of the participant, the introductory texts (updated in [Section 7.6](#sec-update-introductory-texts-round3)), as well as the group result tables with individual answers for each statement.

The code ./analysis/dft3/dft3\_report\_per\_participant.Rmd (automatically called within ./code/dft3/05\_dft3\_to\_render\_individual\_reports.R) uses an iterative loop to create the individualized report for each participant by calling automatically:

* ./code/dft3/01c\_dft3\_define\_cols.R and
* ./code/dft3/02b\_dft3\_prepare\_tables\_participants.R : adds results of the participant to the generic table

It will then call ./analysis/00\_child\_intro\_method.Rmd as well as, for each section, ./analysis/dft3/dft3\_child\_section.Rmd, which will create tables for all questions (type 1) that are in the section (conditional *for loop*), by running one code:

* ./code/04a\_create\_flextable\_results\_type\_1\_participants.R : creates the result table for type 1 statements with individual answers in the section and for their comments

### 7.8.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| /output/reports/dft3/report\_by\_participant/ | dft3\_report\_participant\_X\_YYYY-MM-DD.docx | Individualized reports (one per participant) with date |

Congratulations: **you are now ready** to create your overall synthesis report! Individualized reports created in [Section 7.8](#sec-publish-individualized-reports) can be sent to participants for their information.

# 8. Overall

Once you have finished with the analysis and reports of round 3, this page will guide you through the steps to publish the final overall report which synthesizes results from round 2 and 3 (statistical and graphical summaries).

## 8.1 Update summary image

* ☐ Update the image for the executive summary in the ./analysis/overall/delphiFT\_Overall\_FigureFlow.pptx provided with the details pertaining to your project and save it as ./analysis/overall/ExecutiveSummary\_figure-Flow.png

It summarises the process with dates, number of experts (participants) and number of statements. See [Figure 8.1](#fig-exec-steps) below for an example of this figure using data from the pilot study provided in the demo data (in French).

|  |
| --- |
| Figure 8.1: Overview of the steps for the pilot study of the *fast-track Delphi* process |

## 8.2 Update introductory texts for the executive summary

* ☐ Update the introductory texts on the server
* ☐ Run ./code/00\_update\_texts\_intro.R one more time to update the \*.docx files in your local directory

## 8.3 Modify executive summary report titles and details

* ☐ Open the code ./code/000\_parameters.R and go to section 4
* ☐ Check and modify if necessary title\_overall, subtitle\_overall and authors\_text
* ☐ Update the list of type 1 statements from round 2 that you want to keep in the overall report : statement\_numbers\_in\_dft2\_to\_keep\_for\_execsummary (some statements might have been reformulated despite reaching agreement and consensus)

## 8.4 0\_run\_ME\_overall.R - Publish overall report

* ☐ Run 0\_run\_ME\_overall.R

This code will:

* update the introductory texts by running ./code/00\_update\_texts\_intro.R
* prepare the result tables (only type 1 questions) with combined round 2 and 3 by running ./code/06\_prepare\_tables\_combined\_round\_2\_3.R
* create \\*.xlsx tables for quick checks, if necessary
* publish the overall report (called **Executive summary**) by running ./analysis/overall/overall\_executive\_summary.Rmd

### 8.4.1 Detail of outputs

| Folder | Output file | Description |
| --- | --- | --- |
| ./output/checks/ | chk\_recode\_exec\_summary.xlsx | Quick check table |
| ./output/checks/ | type1\_zz\_combined\_round\_2\_3.xlsx | Quick check table |
| ./output/RData/ | type1\_zz\_combined\_round\_2\_3.RData | Clean data for all type 1 questions from round 2 and 3 |
| ./output/reports/overall/ | dft\_overall\_executive\_summary\_YYYY\_MM\_DD.docx | **Executive summary** |

## 8.5 Finalise overall report

Here are a few tips to be done manually (directly in your Word software) to improve the look and comprehensiveness of your executive summary:

* ☐ Open the summary report using the Word software
* ☐ Add page numbers (still an unsolved problem - see [Stackoverflow question](https://stackoverflow.com/questions/75410413/rmarkdown-officedown-block-landscape-no-page-number))
* ☐ Add your ‘Key messages’
* ☐ Add the “target” images (available in ./\_img/ as \*.png files) in the table headers (sorry, we had trouble doing it by code)
* ☐ If necessary, rearrange the order of the statements within the tables (example: first, statement that have reached consensual agreement by the end of round 2, then those having reached consensual agreement in round 3)
* ☐ Delete the ‘section’ column
* ☐ Adjust the height of the table rows
* ☐ Delete the table ‘Consensual disagreement reached’ if none of your statements have reached a consensual disagreement

|  |
| --- |
| Tip |
| If table captions and/or tables are on next page, it is probably because of paragraph formatting:   * select caption or table and go to Paragraph > Line and Page Breaks tab (Enchaînements in french) * uncheck **Widow/Orphan control** (Eviter veuves et orphelins) and **Page break before** (Paragraphes solidaires) |

… et voilà !

Congratulations for going through all steps of the *fast-track Delphi* process. You are now ready to spread the consensual messages that have been reached by your expert participants. Good luck and enjoy the communication part!

# Appendix A — Resources

Here are some of resources we used to learn and improve our skills with R, RStudio, Quarto and various packages.

Thanks to the contributors of the packages and tutorials.

* [R for Data Science (2e) by Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund](https://r4ds.hadley.nz)
* [Tom Mock. Beautiful Reports and Presentations with Quarto. 2022-09-27](https://thomasmock.quarto.pub/reports-presentations/#/title-slide)
* [Tracy Teal. These are a few of my favorite things (about Quarto presentations). RStudio (2022)](https://www.youtube.com/watch?v=ttLnLdU1-CQ)
* [Quarto Blog - News, tips, and commentary about all things Quarto](https://quarto.org/docs/blog/)
* [David Gohel. Using the flextable R package](https://ardata-fr.github.io/flextable-book/)
* [David Gohel. Officeverse](https://ardata-fr.github.io/officeverse/index.html)

Velarde Crézé, Camille, Luc Lebon, Olivier Duperrex, Vincent Faivre, Myriam Pasche, and Jacques Cornuz. 2023. “Nouvelles Cigarettes Électroniques Jetables « Puffs » : Consensus d’expert-e-s Sur Leur Réglementation.” *Revue Médicale Suisse* 19 (812): 181–85. <https://doi.org/10.53738/REVMED.2023.19.812.181>.