COVINFORM

CORONAVIRUS VULNERABILITIES AND INFORMATION DYNAMICS RESEARCH AND MODELLING

D2.4 Cloud-based interactive dashboard for displaying geospatial layers

Project

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Executive Summary

The COVINFORM project investigates the impact of the COVID-19 pandemic across the 27 EU member states (MS) and the UK. One of the projects outputs includes an interactive risk assessment dashboard that centres on various types of vulnerability (i.e., physical, social, economic and information) and the related consequences, within the context of COVID-19. Extensive work was undertaken to appropriately define the risk assessment framework, which will ultimately provide a risk score for each country and will be visualised on the geospatial dashboard. These insights will offer stakeholders the opportunity to explore their assumptions of risk, particularly for vulnerable groups determined by shared characteristics (e.g., migrants, low socio-economic status, poor health) during public health crises and ultimately inform their future responses.

This report is supplementary to a video demonstration of the dashboard and describes the technical work undertaken to date (August 2022) and the additional features to be added before the dashboard is due for completion in April 2023. **A demonstration of the dashboard can be found here**. To ensure the dashboard meets the requirements of the intended end users, several workshops will be conducted over the duration of the project. The first workshop was conducted in May 2021 and involved both first responders and practitioner partners of the COVINFORM project. The objective was to determine their user requirements, and several insights were gathered and are presented within this report. When the requirements were combined and analysed with the user requirements of other project partners, following a virtual workshop, it was established that the dashboards insights would be most suitable for academics and policy makers.

This report describes the technical development of the dashboard, the included features, such as an overview of the dashboard architecture, the dashboard pages, types of plots and the Knowledge Repository. The Knowledge Repository will host the COVINFORM project outputs and other relevant sources, such as COVID-19 scientific literature and events. The report concludes with a description of the next steps in the dashboard's development pipeline.

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Acronyms & Abbreviations

Term	Description
AWS	Amazon Web Service
CSV	Comma Separated Value
ECDC	European Centre for Disease Prevention and Control
GDPR	General Data Protection Regulation

1 Introduction

The dashboard and this supplementary report (D2.4 - Cloud-based interactive dashboard for displaying geospatial layers) result from the activities carried out in Task 2.4 (Exploratory scenario applications and geo-spatial map overlay with multiple layers) and it provides an interface to the data that have been collected (Task 2.1 Data collection and review), processed (Task 2.2 Data processing and cleaning) and modelled (Task 2.3 Development of risk assessment tools to map the response, impact and consideration of vulnerability in each case study location) from the start of the project until the moment of writing this report (August 2022). Specifically, the dashboard provides user-facing access to the COVINFORM database, described in Deliverable 2.1 Database containing different data sources which will include outputs of the COVINFORM Risk Assessment Model, the first iteration of which has been described in Deliverable 2.3 Technical Report.

In Section 2, the dashboard requirements are described based on the objectives of the project and the end-user requirements. In this section, an overview of the end-user requirements, their status in terms of application and implementation are described. In addition, out-of-scope requirements are noted. In Section 3, an overview of the Dashboards Architecture is described in terms of how the data is catalogued and stored, the search functionalities, the initial user face design and current and planned access to the dashboard. In Section 4, the COVINFORM dashboard pages are presented. The report concludes with an overview of the work to be completed before the dashboard is released in M30, April 2023, of the COVINFORM Project.

2 Dashboard requirements

2.1 Initial end-user requirements

As part of Task 2.5 Evaluation, we conducted our first user requirement workshop on the 25 May 2021 [M8]. Due to the on-going pandemic, the event was held virtually and focused on the data and insight needs of the practitioner partners (MDA, UCSC, AUTRC and SAMUR). The roles of the practitioner partners in attendance included employees of Emergency Medical Services, national disaster management, EU Civil Protection agencies, Red Cross Organisations, and other healthcare provider's medical doctor.

The aim of the evaluation task is to engage end users in the identification and assessment of relevant datasets, indicators, models and evaluation of the outputs. Prior to the workshop, Trilateral shared a User Requirement questionnaire (Appendix 1) with all consortium partners; researchers, first responders and academics. The purpose of this activity was to understand the broad needs of those involved in evaluating the impacts of COVID-19 and to identify gaps in response measures, that could be filled with the creation of a tailored dashboard.

As the project aims to better understand the impacts on vulnerable groups and identifying those most 'at-risk'. We asked each practitioner partner to describe their organisations definition of 'at-risk'; "My organisation currently defines 'at-risk' as [characteristics/s]:"

The collective responses highlighted that single indicators or circumstances cannot adequately determine those at most risk. One respondent stated, "It cannot be unlimited. Risks are not only material". During the workshop, Trilateral presented various published vulnerability indexes and online dashboards:

- NIEHS- COVID 19 Pandemic Vulnerability Index (PVI) (USA)
- INFORM COVID-19 WARNING (EU)
- British Red Cross COVID-19 Vulnerability Index (UK)
- Response2covid19.org (global)

Each have their merits; however, they are either not applicable to our target population (EU 27 member states and the UK) or our objectives to gain insights focused on vulnerable groups (i.e., migrants, precarious workers, institutionalised individuals). In addition, each rely on structured quantitative data and provide no contextual understanding of the various types of risk, the interactions of those risks, both from a systems perspective and community perspective. Over the following year, a risk framework methodology was developed and is reported in D2.3 'Technical Report' submitted in July 2022.

During the workshop in May 2021, a demo of HAMOC, TRI's solution for analysis of human security environment, was presented to the consortium to provide an example of an interactive dashboard that TRI could build. We initially considered building the COVINFORM dashboard by adaptation of the HAMOC interface (Figure 1-4). However, due to the specific requirements of COVINFORM that emerged from the workshop (Table 1), we realised that building a visualisation tool from scratch would allow a faster and more efficient deployment together with higher flexibility. Although the technology underlying the new dashboard will differ from the one used by HAMOC, it will provide the same type of visuals (map-based plots, bar/line charts, scatter plots, graph visualisations from text).

Figure 1. HAMOC dashboard - Map page

Figure 1 shows a screenshot of the HAMOC dashboard shown during the end-users workshop – Map page. The 'Maps' page shows indicators values as choropleth at different national and sub-national levels. **Copyright © Trilateral Research**.

Figure 2. HAMOC dashboard - Plots page

Figure 2 shows a screenshot of the HAMOC dashboard shown during the end-users workshop – Plots page. The 'Plots' page allows end-user to select one or more indicators at a given time point and visualise them on a bar chart. **Copyright © Trilateral Research**.
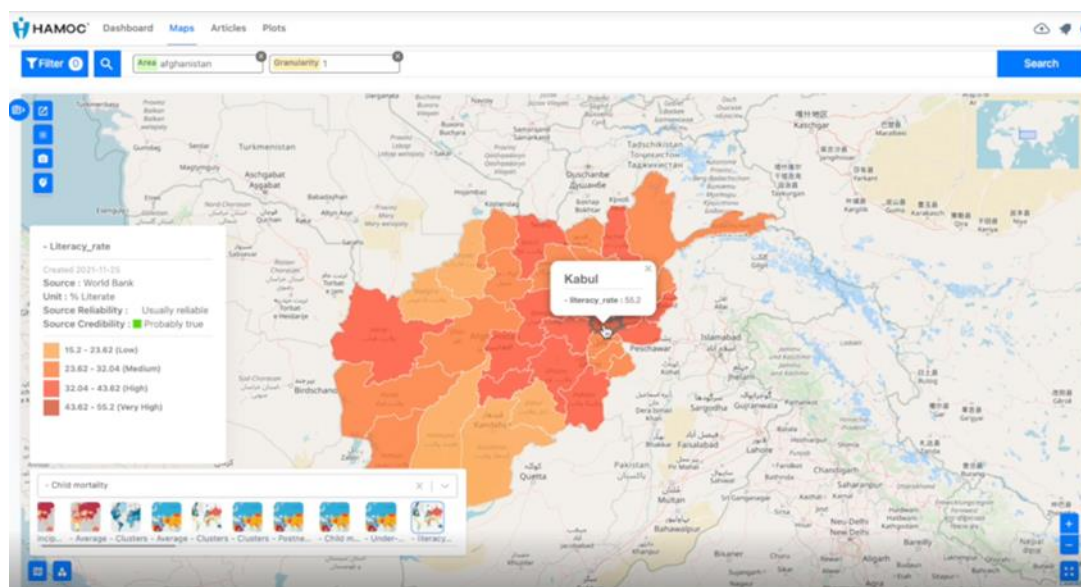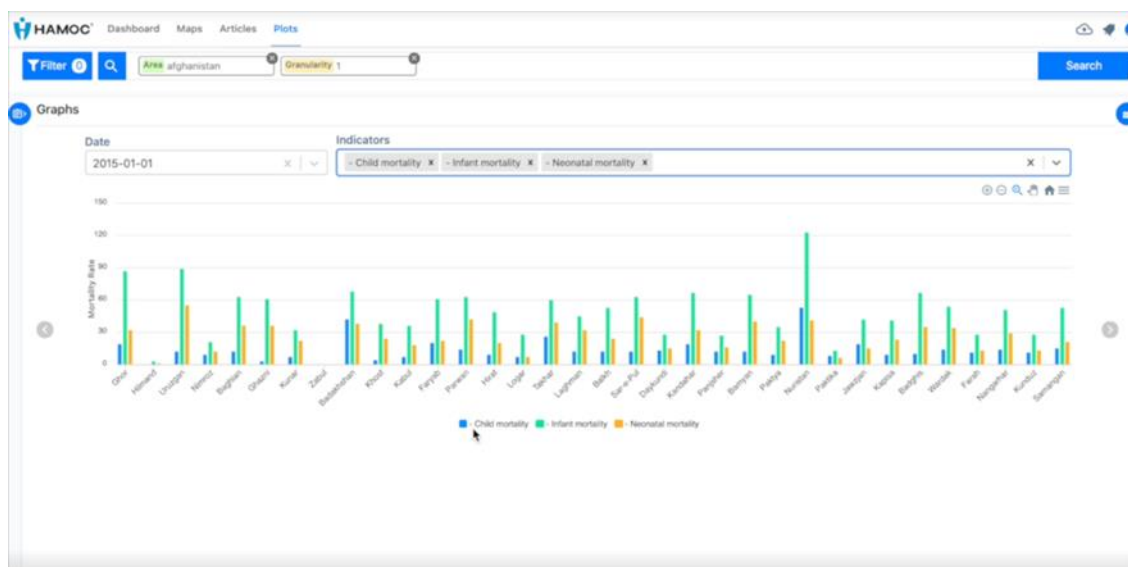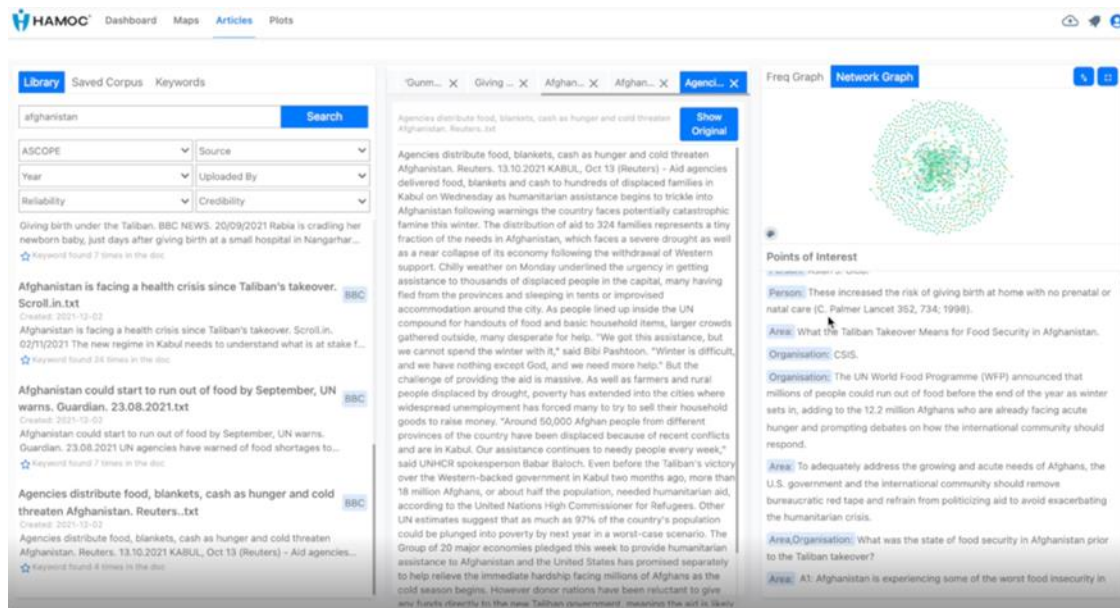
Figure 3. HAMOC dashboard - Article page

Figure 3 shows a screenshot of HAMOC dashboard shown during the end-users workshop - Article page. The 'Articles' page allows end-user to search through articles and reports available in the HAMOC databases (on the left); the text of the selected document is visualised in the middle part of the screen; on the right, a graph connecting annotated entities extracted from the text is generated and relevant pieces of text are highlighted. **Copyright © Trilateral Research.**

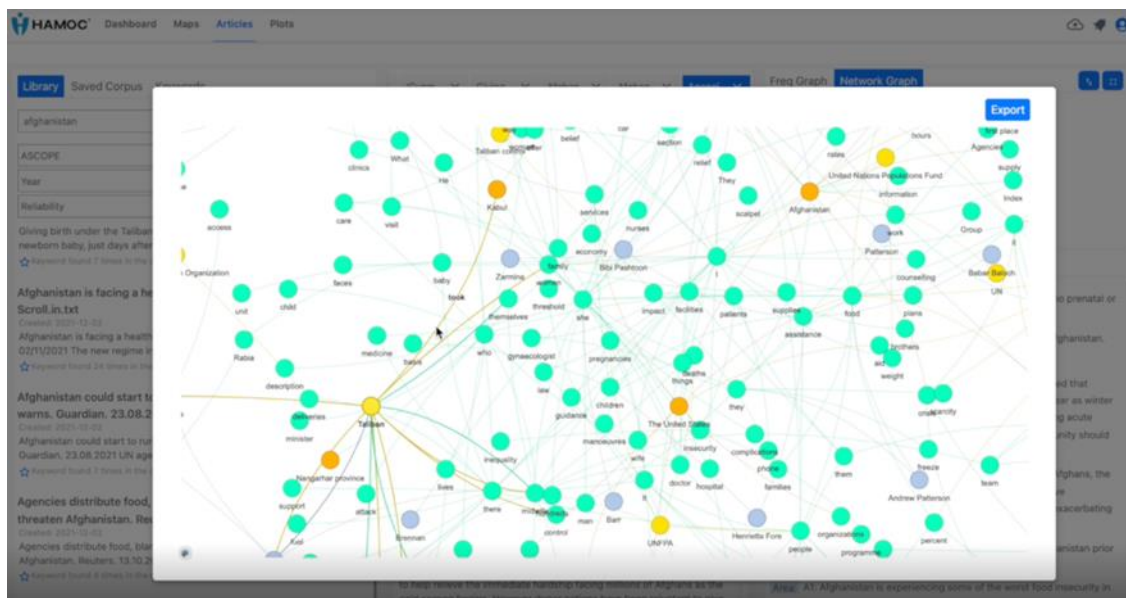**Figure 4. HAMOC dashboard - Network Graph zoom-in**

Figure 4 shows a screenshot of the HAMOC dashboard shown during the end-users workshop – Network Graph zoom-in. Each node in the graph is an entity extracted from the text; the colour of the node indicates the entity category (e.g., yellow nodes are entities of type 'organisations', orange are 'geographic areas'). **Copyright © Trilateral Research.**

Table 1. Initial user requirements (Researchers, Practitioner Partners, Both) *.

Dashboard requirements (user profile: Researchers Practitioner Partners, Both)	Additional information	Implementation status
Users want the tool to be user-friendly and easily accessible	The tool follows design principles to ensure the dashboard is user friendly and accessible. User experience will be tested by partners in Workshop 2 (Oct 2022).	Ongoing
Users want the tool to accommodate for different roles	This requirement relates back to the roles within an organisation. The dashboard will not be used to support operational requirements and will be open source.	Not relevant
Users want the tool to accommodate for country-specific access	This requirement relates back to the roles within an organisation. The dashboard will not be used to support operational requirements and will be open source.	Not relevant
Users want the tool to provide analytics plots together with map-based visualisations	The tool will include analytics plots and map-based visuals a preliminary version of which are provided in the current version of the dashboard. The types of analytics required will be further explored in Workshop 2, October 2022.	Implemented – preliminary version
Users want to be able to upload their own data	The dashboard will not be used to support operational requirements. This requirement is more relevant for analyst type of end-users and is therefore out of scope. Data in the tool are collected and curated by TRI team off-line, based on end-user requirements (this will include integrating research data from WP3-7).	Out of scope
Users want to use the tool to communicate with public	This is beyond the scope of the COVINFORM project.	Out of scope
Users want to use the tool to share information with other countries	This is beyond the scope of the COVINFORM project.	Out of scope
Data requirements	Additional information	Implementation status
Users want the tool to gather, harmonise and standardise data at different geographic levels	The risk assessment model is built on data collected in a standardised way at a national level. Local level data will be standardised following analysis of outputs from WP3 Case Studies from Autumn 2022. The portion of national-level data which has already been processed and harmonised is provided in the current version of the dashboard.	Ongoing
Users want to combine epidemiologic data with data from different domains	Data will be available for all indicators in the risk assessment framework (D2.3), covering a broad range of domains. In addition to other COVID-19 situational data (COVID-19 cases, vaccination rates etc.).	Ongoing

Table 1. Initial user requirements (Researchers, Practitioner Partners, Both) *.

Users want the data used by the tool to be reliable	Data collection activities focus on collecting data from reputable sources (e.g., EUROSTAT, ECDC), with public data records.	Implemented
Users want the tool to provide indications on reliability and quality of the data	Data quality and reliability will be measured and reported on the geo-spatial dashboard. The assessment of which will be reporting in the User Guide. The current dashboard shows the data source of an indicator when hovering over a country.	Ongoing
Users want the tool to provide demographic-disaggregated data	For all data sources were aggregation (predominantly sex and age) is available, this data will be included. A portion of the already processed data provides already this disaggregation.	Ongoing
Users want the tool to collect historic data	TRI team is carrying out data collection and curation of historic data. The tool will provide access to these data, once processed and curated, and the risk model will cover the period from 2019-2021 (following the trajectory of the pandemic). The portion of these data which has been already processed is available in the current dashboard.	Ongoing
Users want the tool to incorporate survey data	The primary focus of data collection activities will be on representative population-based data covering the 27 MS and the EU. Supplementary survey data will not be included.	Out of scope
Users want to be able to test their own hypothesis	Users will be able to generate different plots (e.g., choropleth, time series, bar charts, scatter plots) from the data to gain insights on their research questions. The current dashboard provides a selection of these plots.	Implemented – preliminary version
Analytics requirements	**Additional information**	**Implementation status**
Users want the tool to generate insights from combined data	User will be able to plot different data indicators from various data sources and indicators from different data are combined to produce the aggregated scores according to the risk framework. The current dashboard provides single indicators only and scatter plots of one indicator against another. Aggregated ones will be available as their computations progresses.	Ongoing
Users want the tool to generate insights on vulnerable groups (not only geographically defined) and the general population	The risk assessment framework includes several indicators that describe vulnerability under the domains of physical, social, economic and information. The data will be available to plot and review beyond the risk score. Qualitative data will be incorporated from resident interviews (WP4-7) and case studies (WP3).	Forthcoming
Users want the tool to generate insights at different geographic level	Where data is available, geographically disaggregated data will be incorporated. However, regional disaggregation is not available across the majority MS and indicators available. Therefore, the risk framework will be based on national level data only. The current dashboard includes only national level data.	Ongoing
Users want the tool to provide indicators of reliability and accuracy of the analytics	For each indicator we will provide metrics of reliability, accuracy and uncertainty based on the source and data quality.	Forthcoming

Users want the analytics provided by the tool to be interpretable	The risk scores will be presented in easy to interpret outputs, on ordinal scale and visually like a "traffic light" system. The current dashboard does not provide this functionality as the risks scores have yet to be computed. An info-page on the dashboard will be provide further guidance on the plots' interpretation, together with provision of map scale, legends, axes labels and measure units.	Forthcoming
Users want the tool to provide insights interesting from a research perspective	This requires further elaboration at Workshop 2, October 2022.	Needs to be narrowed down
Users want the tool to provide indicators of impact of COVID on different population	The impact of COVID-19 will be organised into domains of consequences under the risk assessment framework. This includes health, economic, social and environment. The indicators will be available as single sources for plotting.	Forthcoming
Users want the tool to identify, analyse and explain responses to societal crisis management	The design of the risk assessment framework will allow for a composite risk score. Response measures are included in the creation of the final score. This requires further elaboration at Workshop 2, October 2022.	Forthcoming
Users want the tool to gather and analyse patient-level data	This is beyond the scope of the COVINFORM project.	Out of scope
Users want the tool to make short-term prediction on hospitals capacity	This is beyond the scope of the COVINFORM project.	Out of scope
Users want the tool to provide recommendation on responses and strategies	This is beyond the scope of the COVINFORM project. The tool will provide insights which may shape response strategies.	Out of scope
Privacy and governance requirements	**Additional information**	**Implementation status**
Users want the tool to handle data in accordance to country regulations	Individual data will not be reported, only population-based data at national level. For all COVINFORM empirical data, the data will be handled in accordance with the Data Management Plan (D1.5/D1.7) and the Ethics Protocols (D1.4/D1.6).	Not relevant
Users want the tool to comply with privacy regulations	As above, all COVINFORM empirical data, the data will be handled in accordance with the Data Management Plan (D1.5/D1.7) and the Ethics Protocols (D1.4/D1.6).	Implemented

* The column 'implementation status' reports whether the relative end-user requirement has been already considered in the deployment of the dashboard functionalities as well as if the requirement is not relevant, out of scope or needs to be further refined with follow-up end-user engagement.

As illustrated in Table 1., the user requirements for the practitioner partners were largely out of scope of the COVINFORM project. The primary needs of practitioner partners were directly related to operational insights, which would require access to organisation level data. It was determined that the insights that could be generated from the data available at an EU level, would be more appropriate for the needs of researchers and policy makers.

3 Dashboard Architecture Overview

The COVINFORM dashboard has been built to be both simple to maintain for developers, using open-source tools such as Plotly[1] and Dash[2] and as per the user requirements, user friendly, using a simple user-interface and requiring zero technical knowledge. The dashboard can be accessed via the use of any modern web browser with zero additional installation needed. **A demonstration of the dashboard can be found** here. In the following sections, information is provided on cataloguing the data and the storage facility, the search functionality of data sources in the dashboard, the user-face and how the dashboard can be accessed.

3.1 Data Catalogue

The COVINFORM structured data is hosted directly on the AWS S3[3] bucket storage service, as is an index that provides metadata (i.e., data that provides information about other data, such as, the file size or when the data was created) and access information for unstructured data (i.e., data not organized in a pre-defined manner, typically text heavy, such as interview transcripts)

Structured data is stored in comma-separated value (CSV) files with numerical values indexed by indicator, unit, date and reporting country, as well as other indexes relating to disaggregation available for each data source, such as age group and gender for population data or sectors, classes and types for infrastructure and environmental data. Data codes are replaced in these files with full text strings to aid interpretability, and these text strings can be displayed as graph labels, axis titles and graph titles in the dashboard. Each file contains one or more indicators, with multiple indicators being contained in the same file if they were drawn from the same source dataset or database. An example of this is weekly case rate and weekly death rate relating to COVID-19 (Figure 8). Since both of these indicators are drawn from the same European Centre for Disease Prevention and Control (ECDC) dataset, we keep them in the same CSV file.

Unstructured data such as reports, journal papers, links to webpages and technical documentation are not currently hosted directly on S3, but an index in CSV format is provided that provides access details and metadata for all data points. Further information on this index structure is available in sub section 4.

3.2 Data Search

Search functionality for the index used in cataloguing unstructured datasets was built using the prototype STRIAD® search library developed by Trilateral Research. This library allows for not only basic search engine functions, but also the development of automated insights and analysis of results

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[1] https://plotly.com/
[2] https://dash.plotly.com/
[3] https://aws.amazon.com/s3/

generated by any given search query. This can include, but is not limited to, entity recognition, text annotation, and topic modelling of text data.

Different features can be developed to provide insight into a variety of different unstructured datasets. As noted in sub section 4, most of the collected unstructured data collected is some format of text data, which allows for a unified display format for unstructured data insights within the dashboard itself. At present, search results are simply displayed using a name and hyperlink format, but this will be expanded with further features in the future.

3.3 User Interface

The dashboard interface allows for both simple visualisation and analysis of secondary structured datasets collected by the COVINFORM project, and search functionality for unstructured data. These visualisations include colour-coding a variety of datasets on a map of Europe to allow for cross-nation comparison of data, and two varieties of scatter plot for comparing trends in datasets on both a country-by-country and Europe-wide basis. The interface is designed to be intuitive, and error messages are displayed whenever user input may cause errors (for example, when trying to access data in a date range which is not present in the selected dataset).

3.4 Dashboard Access and Sharing

The dashboard will be openly (no login credentials will be required) accessible via the web, though the nature of how this will occur (for example, if it will be accessible via the COVINFORM website or on another internet domain) is still to be defined. The dashboard is currently hosted on TRI's secure servers, and it will run on TRI's servers even after the conclusion of the project.

4 Dashboard Pages

There are three major components to the dashboard:
I. An interactive map of Europe allowing for comparison of datasets reported annually at the national level.
II. Scatter plots for comparing two datasets, both those reported annually and those reporting daily, with trends plotted for the latter.
III. Search functionality for unstructured data, including (but not limited to) scientific literature, bi-monthly reports, and third-party projects.

These components are easily accessed by means of separate tabs displayed at the top of the screen whenever the dashboard is in use.
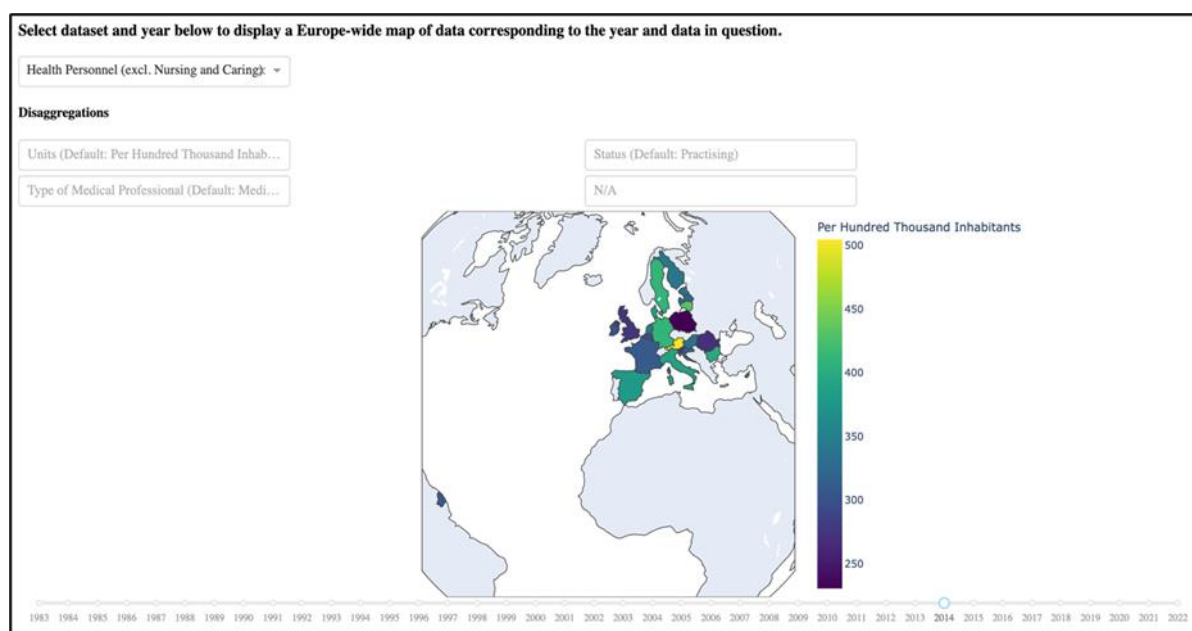
4.1 Charts (Choropleth Map)

Figure 5. COVINFORM Dashboard Choropleth Map of Europe with interactive functionality and risk model scores.
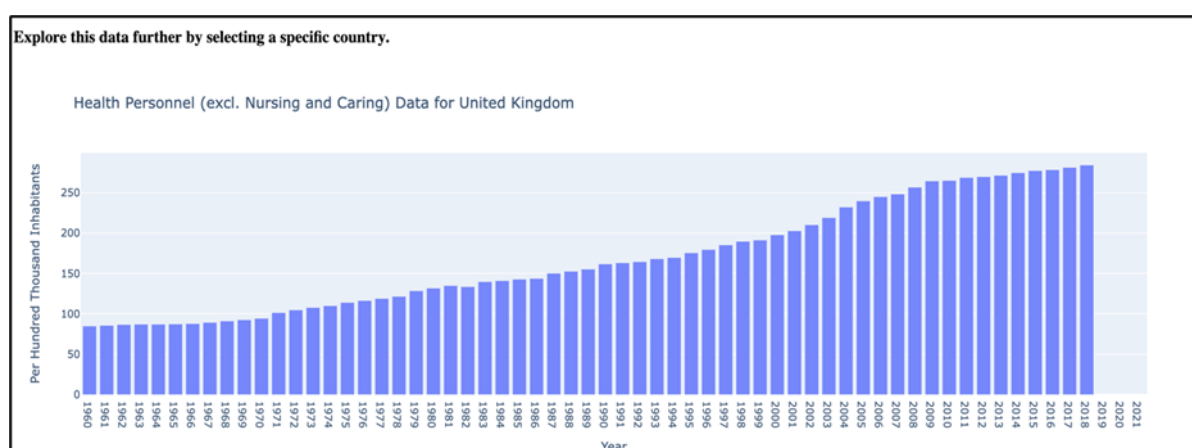

Figure 6. COVINFORM Dashboard plot showing trends over time

The choropleth map ("Charts" tab) displays a breakdown of the selected dataset (selected via a dropdown menu) at the national level (Figure 5). The datasets available for visualisation all have data reported annually, and the year for which data is visualised is selectable using the slider below the map. Not all datasets will have data for all the years listed, but if such data is not available an error message will appear and signify as such.

Map visualisation operates using a simple colour scale, displayed in a legend to the side of the map. This scale varies based on the dataset, but clearly displays differences between the reported national datasets. Nations for which data is not available for that particular year show up as grey.

On hovering over a particular country, further information is available, including the exact data point being plotted, and the data source.

On clicking a particular nation, a bar chart will appear below the choropleth map displaying all data available for this dataset and that nation across all year, allowing for cross-annual comparison and trend insights.

4.2 Comparison Pilot

Figure 7. COVINFORM Dashboard scatterplots showing annual trends overtime using two data sources

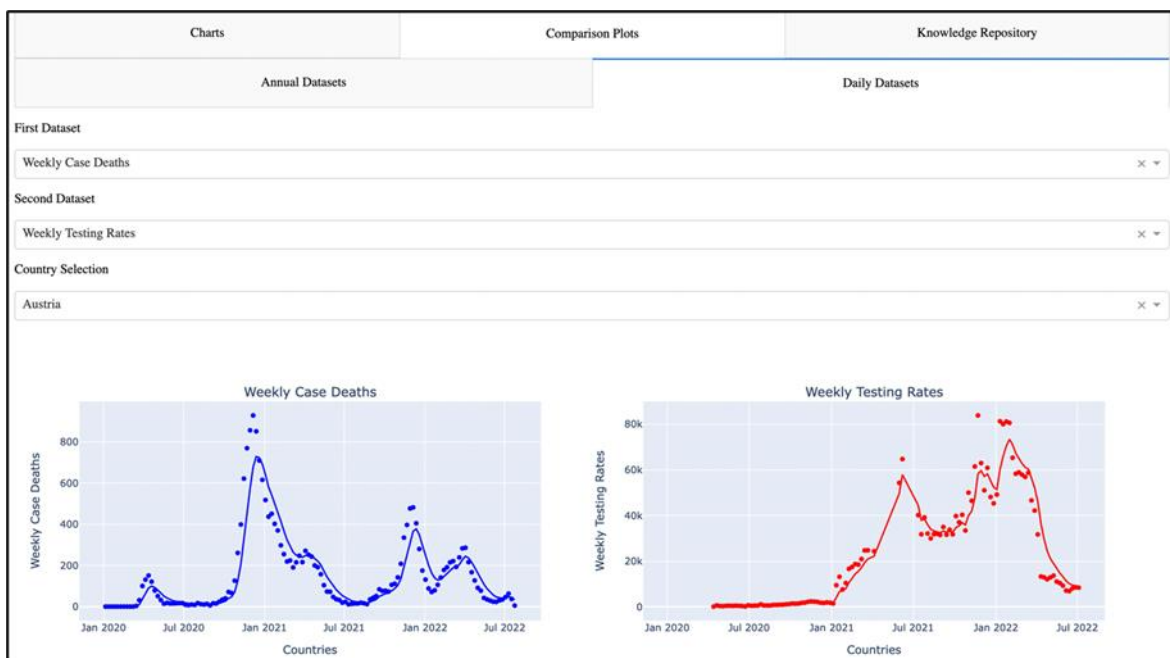**Figure 8. COVINFORM Dashboard showing daily data an COVID-19 impacts (deaths and testing rates)**

Two types of scatter plots are available on the dashboard, both for the purposes of comparing different datasets. The first compares datasets reported annually (Figure 7), and the second covers those reported either daily or weekly over the course of the pandemic, with reporting starting in 2020 (Figure 8).

The annual comparison chart allows for two datasets that have been reported annually to be plotted on two axes against each other, each data point representing a country, for a selected year. Any two datasets reported annually for the same year can be plotted. The daily comparison chart, by comparison, is plotted as two separate graphs displayed over time for a selected country in order to allow for the analysis of trends over time as well as between nations.

4.3 Knowledge Repository

Figure 9. COVINFORM Knowledge Repository

This page provides user-facing access to the COVINFORM COVID-19 Knowledge Repository (Figure 9), currently hosted on the project website[4]. The development of the repository is an ongoing collaborative effort of *Task 8.6.* The repository draws together COVID-19 resources that were identified as relevant for government and public health representatives, CSOs, NGOs, policymakers, and citizens and it integrates the useful outputs of WPs 2-8.

The data catalogue of unstructured data ('Knowledge Repository') the COVINFORM project has put together is varied both in content and in the type of data it represents. Hosted on a variety of platforms accessible via the Web, usually by third-party projects, the task of indexing this variety of datasets relied on classifying the datasets into several different categories, most readily visible on the COVINFORM project website. There are four fields indexed for each item: Name, URL, Category, and Authors (either persons or organisations). This index is currently hosted using the Trilateral Research STRIAD AWS S3 service and can then be searched using the STRIAD search engine outlined in Section 3.2, as well as downloaded directly, if necessary, into a CSV format.

At present, most unstructured data collected by the COVINFORM project is in text (PDF) format, consisting of both project reports and scientific literature. As these PDFs are hosted on third-party sites, the most effective way of providing access to this data via the dashboard is by the formatted results being displayed directly on the dashboard, with the item name and a link to where the data is hosted (if available) displayed.

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[4] https://www.covinform.eu/

5 Next steps

In the following months, the development and testing of the dashboard will continue to achieve a final stable release in April 2023 (M30), when an update of this deliverable is due (D*2.9 Cloud-based interactive dashboard for displaying geospatial layers - update*). The development will continue alongside the data processing and risk modelling effort as the outputs of both activities will directly feed into the dashboard.

New pages. The risk scores for each country will be visualised on a dedicated page which will allow exploration of the scores' breakdown into the different risk components and sub-components. On this page, the end user will be able, for instance, to compare COVID-19 consequences and responses across countries. We also envision the addition of a page where the case studies' outputs are gathered and displayed with visualisations techniques that should favour insights extraction from unstructured text (e.g., knowledge graphs, highlighting relevant entities in the text). Addition of a page with general information on the dashboard in a form a short user guide will also be considered. A landing page for the dashboard is currently being developed by TRI design team.

Improvements to current components. The data indexing will be enhanced to include metadata that allows for more efficient data retrieval and visualisation on the dashboard. This will allow, for instance, to provide additional information on the data sources and quality while hovering over the map and to provide to end-user more disaggregated search functionality. The current plots will also be refined (e.g., considering suitable colours, axis scales, sizes) to increase readability.

Visual identity and design improvements. The current interface will be refactored using a template which will be styled to ensure consistency with COVINFORM visual identity as well as to assure high level of usability and visual clarity.

Technical testing and errors messages. Error messages will be refined to provide more information to the user, and visualisations of all datasets will be further tested to ensure stability. Additionally, further non-functional requirements related to response times and usability will be added and accounted for in development.

End-user engagement and testing. After a working demonstrator has been finalised, usability testing will be conducted by partner SINUS. Usability is defined in *ISO 9241-11:2018 Ergonomics of human-system interaction* as "the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (2018). The guidance defines effectiveness, efficiency and satisfaction as follows:

- Effectiveness: "the accuracy and completeness with which users achieve specified goals"
- Efficiency: "the resources used in relation to the results achieved" (e.g., time, human effort, cost, and materials)
- Satisfaction: "the extent to which the user's physical, cognitive and emotional responses that result from the use of a system, product or service meet the user's needs and expectations"

ISO/IEC 25066:2016 Systems and software engineering furthermore specifies minimum requirements for different types of usability evaluations:

Table 2. Requirements for usability evaluations

Type of evaluation	Inspection	User observation		
		Observing user behaviour	**Measuring user performance and response**	**Information from users**
Physical environment and facilities	N/A	Required	Required	Optional
Technical environment	**Required**	**Required**	**Required**	**Required**
Evaluation administration tools	Recommended	Recommended	Recommended	Recommended

As the COVINFORM dashboard is a technical environment, the usability testing will utilise the following methods to meet the following requirements and measure the following constructs:

Table 3. Requirements, methods, constructs, and data types

Requirement	Method	Construct	Data type
Inspection	Cognitive walkthrough for the web (Blackmon et al. 2002)	Effectiveness, efficiency, satisfaction, accessibility	Qualitative
Observing user behaviour	Concurrent think-aloud (Ericsson and Simon 1993) with exit interview	Effectiveness, efficiency, satisfaction, accessibility	Qualitative
Measuring user performance	Quantitative performance metrics	Effectiveness, efficiency	Quantitative
Measuring user response	System usability scale	Satisfaction	Quantitative
Information from users	Socio-demographic questionnaire	User attributes	Quantitative

The tests are conducted in four iterations:

- **Iteration 1**, which was already held, entailed a requirements elicitation workshop.
- **Iteration 2 and 3** will comprise two cognitive walkthroughs for the web workshops, conducted with selected consortium partners and external participants, respectively.
- **Iteration 4** will comprise concurrent think-aloud tests with supplementary quantitative questionnaires and qualitative interviews.

The reporting will adopt the structure recommended in *ISO/IEC 25066:2016 Systems and software engineering*. It will be accompanied by a practical user guide designed for end-users themselves, co-written by the partners responsible for the testing (SINUS) and the development itself (TRI).

6 Conclusions

This short report describes the technical development for building the COVINFORM geo-spatial visualisation dashboard (Task 2.3). In addition, it provides an overview of the initial user requirement gathering activities (Task 2.5). Over the following months, WP2 activities will continue to focus on finalising the data collection and processing (the final database will be reported in the M30, April 2023, update of D2.1), with particular focus on novel techniques to integrate the qualitative outputs from WP4-7 and the case study findings in WP3. The risk assessment modelling activities will continue as described in D2.3 and the final model performance will be reported in M28, February 2023. Deploying the risk model following the defined scoring approach and theoretic framework together with validating the model's outcome will be reported in the M28. The dashboard will be demonstrated to project partners in October 2022, in the second of three planned *Evaluation* workshops. Then in D2.4, the final dashboard will be submitted in M30, April 2023.

Appendix

User Requirement Questionnaire

COVINFORM Partner Questionnaire – User Requirements [WP2]

Purpose: The purpose of this questionnaire is to gather the COVINFORM partners initial user requirements for the interactive, geospatial cloud-based risk assessment model built in WP2 with end-user involvement (Task 2.5).

Aim: To identify and assess relevant datasets, indicators and models that will inform the development of risk assessment tools to map the impact of governmental responses to COVID-19, with a specific focus on vulnerable groups.

Methods: To understand the needs of project partners, 'User Stories' will be obtained from each participating project partner. User stories are used to capture (and discover) the desired product functionality and its value from the user's perspective. The value of employing user stories is that they compel both the developer and the end user to focus on understanding the *why* part of the user requirement.

Participants: All COVINFORM project partners will be asked to submit their 'User Stories' prior to the first User Requirement Workshop. To gain the most valuable insights, we would ask that more than one participant per partner organisation completes the questionnaire. Ideally, multiple partner roles and fields of work will be represented in the final responses.

User Stories (Pre-workshop User Stories)

Thank you for taking the time to consider our questionnaire. We hope to gain some insights from your experience in accessing data and information during the pandemic.

Please complete all questions.

My role is _____ and involves:

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1. In my role, I want to [conduct/respond/identify/gain insight]:

   in [geographical area level]

   so I can achieve [outcome]:

2. "During the pandemic, within my role, I typically sought data/information regarding vulnerable groups from (e.g., websites, groups, institutions, individuals)
   (*include a list of resources including publicly available and institutional datasets*):

3. And what was this data/information used for?

4. I was usually [satisfied/dissatisfied] with the data/information available.

5. In cases in which I was mostly satisfied, it was due to the data/information or data sources being (please list all positive attributes):

6. In cases in which I was mostly dissatisfied, it was due to the data/information or data sources being (please list all negative attributes):

7. Can you describe the last time you sought data on vulnerable groups and detail the process that you followed?

8. What level of technical knowledge or experience was required for you to interpret the data/knowledge to make decisions?

9. What barriers or challenges did you face in identifying at-risk groups, and finding implementable and trusted actions, which achieved meaningful impacts?

10. My organisation currently defines 'at-risk' as [characteristics/s]:

   but this doesn't account for [characteristic/s]:

11. Is your organisation's definition of 'at-risk' formal/explicit or informal/implicit?

Thank you for completing the questionnaire.

Please send your completed questionnaire to the WP2 Leader at Trilateral Research (Niamh Aspell; Niamh.aspell@trilateralresearch.com and Su Anson Susan.anson@trilateralresearch.com).