

Advanced management system for participants in the LUCIA study

Bilbomática, a company integrated in the ALTIA Group, participates in the LUCIA project by developing a **portal** to facilitate users, especially researchers, to access to the different tools and models created within the project. Additionally, we have created the **electronic Case Report Form for Lung Cancer**, eCRF from now on, a digital system that manages data securely and is essential for clinical trials.



Based on the definition, done by the clinical partners and researchers, of the clinical protocols, recruitment criteria and follow-up procedures, we have built a system that allows to support the four public hospitals participating in the LUCIA consortium.

Regarding the technologies used in our developments, we basically use **Java, Angular and PostgreSQL** as the Data Base engine. We also integrate Keycloak in our security measures.

In terms of **design**, we have applied **UX principles** to achieve a **simple, intuitive and fast system for end users**, both clinicians and researchers.

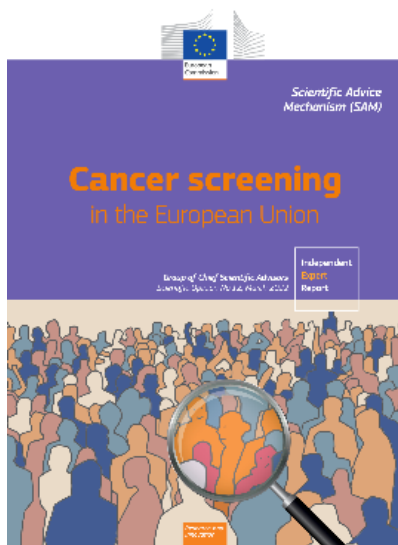
The eCRF collects all the variables that the clinical partners consider **important as they could affect patients' risk of developing Lung Cancer**. These variables have been grouped into

- Demographic data
- Physical examination
- Clinical history
- Personal health history
- Family medical history
- Smoking history
- Occupational exposure to harmful substances
- Lifestyle and quality-of-life questionnaires
- Blood test results
- Devices testing performed
- Computed tomography (CT)

The screenshot displays the ALUCIA CRF interface. At the top, the header includes 'ALUCIA | CRF' and navigation options like 'From Subjects', 'Efficacy', and 'Progress'. Below the header, there's a patient identifier 'BI-0017' and a phase indicator 'Phase 1 - Visit 1 (2024/12/05)'. The main content area is titled 'Story about smoking (exposure history)'. It contains several sections with radio button and dropdown inputs:

- Relationship with tobacco throughout life:** Radio buttons for 'Smoker', 'Ex-smoker', and 'Never smoker'. 'Smoker' is selected.
- Smoker section:**
 - 'At what age did you start smoking regularly?': Input field with '3'.
 - 'How many cigarettes do you smoke per day?': Input field with '10'.
 - 'How many years have you been smoking?': Input field with '3'.
 - 'Packager-year index (PPI)': Input field with '1.5'.
 - 'Have you smoked at least 100 cigarettes in your entire life?': Radio buttons for 'Yes' (selected) and 'No'.
 - 'In the last month have you smoked, even just one puff?': Radio buttons for 'Yes' (selected) and 'No'.
 - 'Do you smoke more during the first few hours after waking up than during the rest of the day?': Radio buttons for 'Yes' (selected) and 'No'.
 - 'Do you smoke more when you are so sick that you spend most of the day in bed?': Radio buttons for 'Yes' (selected) and 'No'.
 - 'Type of tobacco or substance': Dropdown menu with 'Cigars, Pipe' selected.
 - 'How often do you smoke cigars?': Radio buttons for 'Every day' (selected), 'Sometimes', and 'Never'.
 - 'How often do you smoke a pipe?': Radio buttons for 'Every day' (selected), 'Sometimes', and 'Never'.
- Positive exposure to tobacco at work:** Radio buttons for 'Yes' and 'No'.
- Positive exposure to tobacco at home:**
 - 'In any of your family members a smoker?': Radio buttons for 'Yes', 'No', and 'I do not know'.
 - 'Do you currently live with a smoker?': Radio buttons for 'Yes', 'No', and 'I do not know'.
 - 'Did anyone smoke in your home when you were under 18?': Radio buttons for 'Yes' and 'No'.
 - 'Was smoking allowed inside the house?': Radio buttons for 'Yes' and 'No'.
 - 'After the age of 18, has anyone smoked at home?': Radio buttons for 'Yes' and 'No'.
 - 'For how many years have you lived with smokers?': Input field.

At the bottom, there is a checkbox 'Mark this section completed' and 'Cancel' and 'Save' buttons.

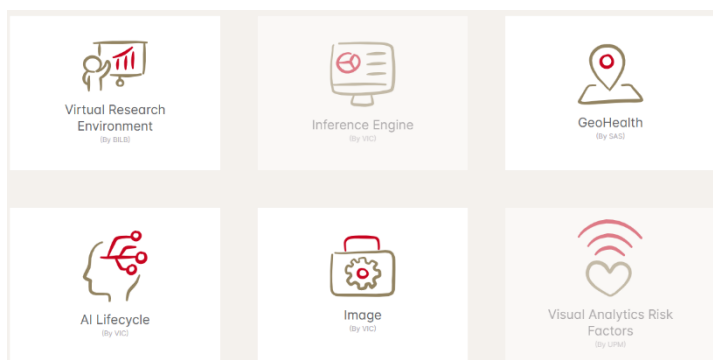


The **main objective of LUCIA** project is to enable researchers to **establish innovative and effective criteria for lung cancer screening**, aligned with the current European directives.

To achieve this goal, the eCRF digital system will facilitate the access to the **most currently used standard risk algorithms**, such as **LCRAT (Lung Cancer Risk Assessment Tool)** and **LLP v2 (Liverpool Lung Project)**, to more accurately assess individual risk and **optimize the selection of candidates for screening programs**.

An **early identification** of people at high risk for developing Lung Cancer, will increase the population that could **benefit from screening programs**, increasing the effectiveness of early diagnosis, improving treatment outcomes and increasing overall survival.

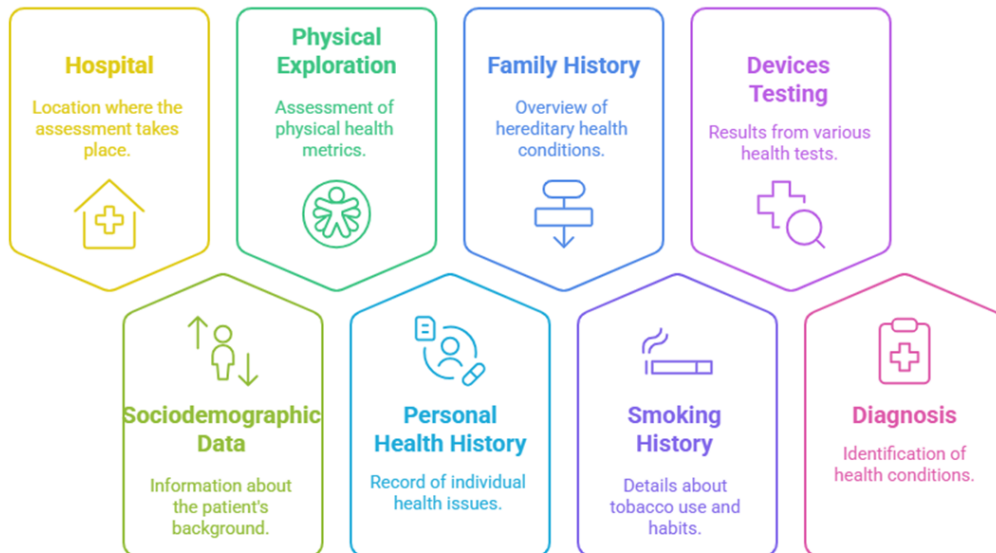
Additionally, Bilbomática has developed the "**LUCIA Research Environment**," the portal for the researchers participating in the project, including the modules:



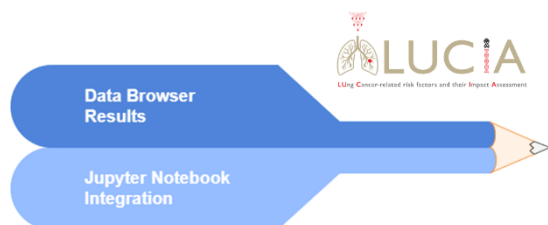
Virtual Research Environment
Inference Engine
GeoHealth
AI Lifecycle
Image
Visual Analytics Risk Factors

Specifically, in the **Virtual Research Environment** module, Bilbomática has implemented a **Data Browser**. Which allows researchers to **extract all the data from a subset of cases** selected on the basis of the information they contain on different variables such as: Hospital, Gender, Year of birth, Ethnicity, BMI, Personal health history, Family history, Relationship with tobacco, devices testing performance (BAN, SPOC, WBSP), Diagnosis (Lung cancer, IPN).

Medical Assessment Components



Unified Data Science Tools



Finally, the Data Browser integrates its results with Jupyter Notebook, a widely recognized interactive tool commonly used in research, data science, and advanced statistical analysis.

References:

- **European directives on lung cancer screening:**
<https://op.europa.eu/en/publication-detail/-/publication/519a9bf4-9f5b-11ec-83e1-01aa75ed71a1>
- **Information on LCRAT:**
<https://dceg.cancer.gov/tools/risk-assessment/screen-lung-cancer>
- **Information on LLP v2:**
<https://www.ncbi.nlm.nih.gov/books/NBK362751/>



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