Titolo: Implementation of a prospective observational study to assess the impact of exposure to air pollution on asthma exacerbations using a digital infrastructure for remote monitoring of patients (BREATHE)

Codice Progetto: 2022EC49YC

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Budget totale progetto: 243.758,00 €

Budget UNIPD: 107.918,00 €

Abstract del Progetto: Big data, Internet-of-Things (IoT) and Artificial Intelligence (AI) technologies have the potential to change our lives and provide us with new perspectives on environment and health. BREATHE aims at leveraging big data, IoT and AI to study the effect of air pollution on asthma, a high-prevalence chronic respiratory disease. In particular, the goal is to establish the link between the personal exposure to air pollution and the occurrence of asthma exacerbation events, i.e., acute worsening of respiratory symptoms, which can have fatal short-term consequences (e.g., death) and dangerous long-term consequences (e.g., recurrence of exacerbations and accelerated lung function decline).

To achieve this goal, BREATHE will develop a remote patient monitoring infrastructure to monitor asthma patients and their living environment during their everyday life. The platform will be deployed for conducting a 12-month observational study in 120 asthma patients attending the Respiratory Disease Clinic of the University of Padova.

The platform will include three IoT sensors, a mobile application, a cloud database and a Web application. Sensors will include a wearable sensor of air quality, enabling estimation of personal exposure to air pollution, a wearable sensor of activity and sleep, and a portable sensor of respiratory function. The mobile app will integrate standardized questionnaires to collect patient-reported data about symptoms, medication use, lifestyle, healthy behaviours, and wellbeing. The cloud database will integrate the data collected by the sensors and the app, as well as other medical data coming from the electronic health records and open environmental data related to the patient's living environment. This will create a multidimensional heterogeneous data ecosystem linking health data with environmental data in asthma patients. Finally the Web application will enable authorized stakeholders (clinicians and data analysts) to remotely access and analyze the collected data.

The environmental data collected by wearable air quality sensors and open environmental data will be used to identify environmental exposure indices to quantify each patient's personal exposure to air pollution on a fine temporal scale. The environmental factors that most increase the risk of asthma exacerbations will be identified by applying data-driven modelling techniques (e.g., machine learning and deep learning techniques) and variable ranking algorithms. BREATHE will develop new AI models to predict the individual risk of experiencing a future asthma exacerbation, by taking into account the strongest environmental predictors and other relevant patient-generated data collected by the app and the IoT sensors. The models might help predict the occurrence of exacerbations, and thus they will potentially enable the planning of suitable interventions (e.g., behaviour change or drug administration) for preventing exacerbations, or reducing their severity.

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