Models and simulation techniques for discovering diabetes influence factors

ABSTRACT and GENERAL GOALS

Interest in identifying people at risk of developing Type 2 Diabetes Mellitus (T2DM) has gained extreme importance especially at its asymptomatic phase, when early interventions have a proven beneficial effect on clinically meaningful outcomes. The current diagnostic criteria are focused on identifying groups with significantly increased prevalence of microvascular complications. This suggests that the current diagnostic methods are missing the opportunity to identify IGT and IFG (pre-diabetes) and early symptoms of T2DM, which leads to a late identification and treatment of patients and the consequent development of complications, which could be avoided with an earlier intervention. This paper introduces the MOSAIC project which aims at improving the current standards for diabetes diagnosis and management.

The MOSAIC project aims at developing tools to:

- Predict the onset of T2DM, IGT, IFG
- Improve characterization of the aforementioned patients

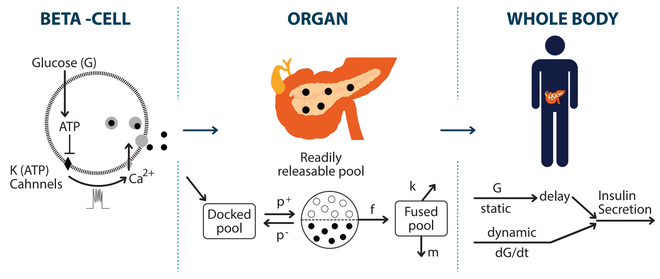
Integrating these tools into a diabetes management platform that supports:

- Stratification of the population at risk
- Personalized treatments and definition of the care pathways
- Enhanced professional decision support systems.

MOSAIC DATA MODELLING

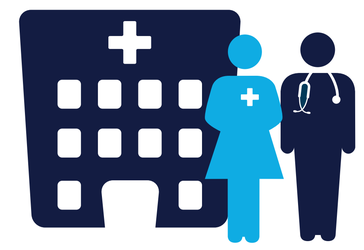
Population modelling. Epidemiological studies and analysis

MOSAIC GOALS: Within MOSAIC we will use information coming from epidemiological studies to improve and enhance the diabetes models. **(Samfundet Folkhalsan i svenka Finland RF, Asociación Española para el Desarrollo de la Epidemiología Clínica).** Probabilistic modelling with Bayesian Networks of glucose regulation, to discover novel physiological biomarkers of T2DM. **(Università degli studi di Padova)**. Multi-scale modelling of the physiological biomarkers, to increase the understanding of the cellular mechanisms beyond glucose regulation. **(Università degli studi di Padova)**.



Process modelling and mining

MOSAIC GOALS: Data mining to elucidate the mechanisms underlying the onset and evolution of T2DM. Data mining to guide and support diagnosis process. Temporal Data Mining methods to extract frequent complex temporal patterns from clinical data and to detect the temporal events that characterize the clinical history of patients after diagnosis. (**Università degli studi di Pavia).** Elucidating the role of behavioural factors in diabetes evolution and management of care. Use of individual patient's histories to forecast disease complication through multivariate temporal modelling. **(Soluciones tecnológicas para la salud y el bienestar S.A)**.



STUDIES and DATABASES ACROSS EUROPE

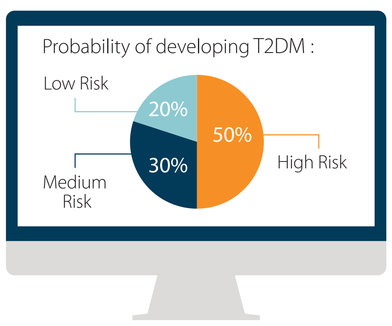
1 - SPAIN. VIVA (study): aimed at describing the most frequent cardiovascular risk factors (CVRF) clustering related to the metabolic syndrome (MS) in a non-diabetic cohort. **Healthy Breakfast (study):** To design a standard breakfast as a substitute for the OGTT, to be performed at home. **La Fé (hospital database):** Database of clinical data retrieved during the daily activity in the Health Department, including hospital and primary care. **Managed Outcomes (study):** Healthcare processes for diabetes patients in primary care.

2 - ITALY. FSM (hospital database): Database of clinical data retrieved during the daily activity in the Diabetology Ambulatory. **ASL Pavia (administrative database):** Continuous Integration Data Warehouse of and administrative data of T2DM patients in Pavia, Italy.

3 - SWEDEN and FINLAND. BOTNIA (PPP and BPS) (studies). The Botnia study includes today approx. 10,000 individuals from 1400 families. Of them, about 3400 have diabetes and 1000 have IGT or IFG. Around 2800 non-diabetic individuals have been prospectively followed during a mean time of 8 years (the Botnia Prospective Study). The PPP–Botnia study is a population-based study designed to obtain accurate estimates of prevalence and risk factors for diabetes, impaired glucose tolerance and the metabolic syndrome.

4 - GREECE. Hippokration General Hospital of Athens (hospital database). It tracks the continuous follow-up of 658 T2DM patients.

MOSAIC MANAGEMENT TOOL

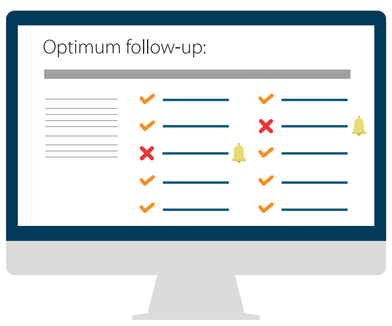


Risk Factors for T2DM Detection and Prediction

Given a set of minimum input variables, personalized tools provide to different healthcare professionals information about the current and future risk of having T2DM for a given population or individual. One key functionality is that the tools have the capacity to estimate the most probable values for unkown or not available clinical parameters, e.g. Cholesterol, History of Stroke events, etc.

Hospital Care Management

This tool is used by a healthcare agency/hospital head of service to understand the processes that are deployed in the health care area in a friendly way. Users can visualize summary statistics on the assisted population and, with the help of advanced data mining techniques, can explore the most frequent temporal patterns in terms of hospitalizations, complications, disease evolution, and treatment options.



Clinical Decision Support in Follow-up Visits

During follow-up visits, physicians are assisted for a better management of an individual patient. It is possible to have a snapshot of the patient's situation at the most recent encounter, and to visualize his/her whole temporal history related to interesting clinical variables, lifestyle, level of complexity, risk scores, and medications.

www.mosaicproject.eu I Facebook: Mosaic Project I Twitter: @mosaicprojecteu

MOSAIC is supported by the European Commision: FP7 - 600914

European Commision Information Society and Media