Real-world evidence evaluation of LDL-C among hospitalized patients: a population-based observational study in the timeframe 2021-2022

Umberto Capece[1,2], Chiara Iacomini[3], Teresa Mezza[1,2,4], Alfredo Cesario[5,6], Carlotta Masciocchi[3], Cassandra Morciano[1,2], Shawn Gugliandolo[1,2], Stefano Patarnello[3], Andrea Giaccari[1,2], Nicoletta Di Giorgi[3]

[1]*Centro Malattie Endocrine e Metaboliche, Dipartimento di Scienze Mediche e Chirurgiche, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy.*
[2]*Dipartimento di Medicina e Chirurgia Traslazionale, Università Cattolica del Sacro Cuore, Rome, Italy.*
[3]*Real World Data Facility, Gemelli Generator, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy*
[4]*Pancreas Unit, CEMAD Centro Malattie dell'Apparato Digerente, Medicina Interna e Gastroenterologia, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy*
[5]*Gemelli Digital Medicine & Health, Rome, Italy*
[6]*Open Innovation Unit, Scientific Directorate, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy*
https://doi.org/10.56095/eaj.v3i1.64
Umberto Capece: capeceumberto@gmail.com

Aims: European registries and retrospective cohorts highlighted the lack of low-density lipoprotein-cholesterol (LDL-C) goal achievement in many very high-risk patients. Hospitalized patients are often frail, and frailty is associated with all-cause mortality and cardiovascular mortality. Aim of this study is to evaluate LDL-C levels in a Real-World setting of inpatients, identify cardiovascular risk categories and highlight treatment gaps in the implementation of LDL-C control.

Methods: This retrospective, observational study included all the adult patients admitted at an Italian hospital between 2021-2022 and with LDL-C values available during hospitalization. Disease-related real-world data were collected from Hospital Information Systems using automated data extraction strategies and through the implementation of a patient-centered data repository (the Dyslipidemia Data Mart). Assessment of cardiovascular risk profiles, LDL-C target achievement according to the 2019 ESC/EAS guidelines and lipid-lowering therapies (LLT) use were performed.

Results: 13,834 patients were included: 17.15%, 13.72%, 16.82% and 49.76% were low (L), moderate (M), high (H) and very high-risk (VH) patients, respectively. The percentage of in-target patients was progressively lower moving towards worse categories (78.79% in L, 58.38% in M, 33.3% in H and 21.37% in VH). Among LLT treated patients in VH category, in-target are 28.48%; 47.6.% in H, 69.12% in M and 68.47% in L. The impact of monotherapies and combination therapies on target achievement was also analyzed.

Conclusions: This study depicts LDL-C control among an entire population of inpatients, highlighting relevant gaps especially in VH category. Future efforts must aim to reduce the cardiovascular risk of these subjects.

Using AI to identify left ventricular ejection fraction from the ECG: The SOLOMAX (SOciaL NetwOrk of MedicAl Experiences) project

Alfonso Ferrara, Valeria Visco, Antonio Robustelli, Francesco Loria, Antonella Rispoli, Andrea Martorella, Albino Carrizzo, Alessia Bramanti, Gianni D'Angelo, Carmine Vecchione, Michele Ciccarelli

University of Salerno, Italy
https://doi.org/10.56095/eaj.v3i1.66
Alfonso Ferrara: ferrara.alfonso5@gmail.com

Aim: The interest in machine learning-based algorithms in the cardiovascular field is rapidly growing, especially for diagnostic and prognostic purposes. Recent evidence has demonstrated that certain electrocardiographic (ECG) parameters are predominantly associated with systolic function, estimated as left ventricular ejection fraction (LVEF) by echocardiography, albeit with still relatively low accuracy.

Consequently, this study aims to develop an AI-based model capable of predicting LVEF from ECG data in an Italian population.

Methods: Within the SOLOMAX project, we collected paired ECG-Echocardiography exams from 105 patients (64.82 ± 16.02y; 62.86% male). Precisely, we excluded patients with atrial fibrillation at the time of the ECG, PMK or electrostimulated rhythm, valve prostheses, previous cardiac surgery, O2 therapy or COPD, previous ablation or invasive electrophysiology procedures, currently hospitalized for Takotsubo or ACS, heart failure exacerbation, inotropic therapy, ACS over the last 3 months. We recorded anthropometric, clinical, biochemical, ECG, and Echocardiography parameters. The collected data was studied using AI-based techniques to create a new model to predict LVEF from ECG. Using an approach based on evolutionary algorithms, genetic programming was used. This approach solves a symbolic regression problem through genetic algorithms and provides a mathematical model of the relationship between ECG parameters and LVEF. The formula obtained was then used to build a simple explainable classifier, which provides a global interpretation of the link between ECG parameters and LVEF.

Results: The performance of the proposed approach and the reliability of the results were assessed using the k-fold cross-validation method and by estimating standard metrics derived from the confusion matrix associated with a binary classifier, that is, accuracy, sensitivity, specificity, precision, and F-Measure. The proposed approach consistently demonstrated its ability to distinguish patients with preserved LVEF from those with reduced LVEF. Each metric averaged across all experiments scored approximately 95%. Furthermore, in the expression generated by the AI model, the axes of the P, QRS, and T waves play a prominent role, as they are likely to provide a better interpretation of the three-dimensional cardiac geometry and, consequently, cardiac function.

Conclusions: AI applied to ECG data can be used to create cost-effective diagnostic and predictive tools for assessing LVEF. Indeed, the obtained formula highlights the relationship between ECG parameters and LVEF, as well as its complexity, which can aid in detecting heart diseases.