Results: The Area Under the Curve Receiver Operating Characteristic (AUC) of the different models to differentiate DPP6 positive from negative family members, was 0.69-0.85. The best performing DL models were a 1D CNN (AUC 0.85) using raw waveform data and a 2D CNN (AUC 0.82) using an image of the mean P-QRS-T complex of each lead. 2D CNN GradCAM showed the QRS complexes of leads I and V5, among other activated ECG regions, to be most important (Figure 1).

Conclusion: In contrast to previous standard ECG analyses, DL models can detect the DPP6 IVF risk haplotype with good accuracy. In addition, GradCAM uncovered that lateral lead QRS complexes were of most importance, matching with the inferred pathophysiological mechanism of increased Ito in Purkinje. It is important to take into consideration that the saliency of heat-map patterns in I and V5 is not the consequence of a targeted optimization, but the emergent result of training the model to perform the binary decision task, highlighting the most relevant information for this task. However, ultimately, DL models might be able to identify pre-symptomatic IVF patients in and outside the DPP6 risk haplotype, enabling patient tailored pre-symptomatic treatment.

PO-631-04

ACCURACY OF A SMARTWATCH ECG TO DIAGNOSE ATRIAL FIBRILLATION AND NORMAL SINUS RHYTHM
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Background: Select smartwatches offer the ability to record a single-lead ECG with automated detection of atrial fibrillation (AF). The growing use of these devices by consumers is accompanied by mass screening of AF. However, the accuracy of the smartwatch automatic diagnosis (SWAD) of AF has only been validated in limited number of patients, often excluding patients with comorbidities or low/high heartrates.

Objective: We assessed the ability of SWAD to correctly detect AF or normal sinus rhythm (NSR) with a 12-lead ECG expert diagnosis in a large cohort of patients with various ECG anomalies.

Methods: 734 consecutive hospitalized patients (without exclusion criteria) underwent a 30-seconds Apple Watch recording and a simultaneous 12-lead ECG. The SWAD (“normal”, “AF” or “inconclusive”) was compared with the smartwatch ECG and 12-lead ECGs as interpreted by two cardiologists.

Results: Of the 734 patients, 547 were in NSR (75%) and 187 were in supraventricular tachycardia (SVT, 25%) including AF, atrial flutter (AFL) or atrial tachycardia (AT). Overall, the SWAD was NSR in 455 (62%), AF in 137 (19%) and inconclusive (IC) in 142 patients (19%). For the whole cohort, sensitivity and specificity for AF and AFL/AT was respectively 70% and 81%. For patients in NSR, 105 were classified as AF or IC. Of these false positives, 27 (26%) had sinus node dysfunction, 19 (18%) had second or third degree AV block, 18 (17%) had premature ventricular contractions (PVCs), 18 (17%) had an intraventricular conduction delay (IVCD) and 9 (9%) had a ventricular paced rhythm. For patients in SVT, 58 were classified as NSR or IC. Among these false negatives, 21 (36%) had an IVCD, 7 (12%) had a ventricular paced rhythm, and 5 (9%) had PVCs. Moreover, for patients in AFL/AT the SWAD identified “AF” in only 1/22 patients. When excluding patients with IVCD, PVCs and paced rhythm, sensitivity and specificity for AF was 77% and 83%.

Conclusion: In 734 patients with various ECG anomalies, the SWAD failed to identify patients with AF and AFL/AT in a significant proportion of patients. The clinician needs to take these limitations into consideration when using smartwatch automatic diagnosis for the detection of AF.

PO-631-05

A MOBILE APP FOR IMPROVING THE COMPLIANCE TO REMOTE MONITORING OF PATIENTS WITH CARDIAC IMPLANTABLE DEVICES: A MULTICENTER EVALUATION IN CLINICAL PRACTICE
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Background: The use of remote patient monitoring (RPM) is recommended for patients with cardiac implantable electronic devices (CIEDs). The continuity of monitoring is crucial, indeed patients who consistently transmit data using RPM were shown to be at substantially lower risk of death and readmission. The MyLATITUDE Patient App (Boston Scientific) has been developed to encourage patient compliance to RPM by providing him with information about communicator setup and troubleshooting, connection status of the communicator, scheduled transmissions, status of the implanted device battery.
**Objective:** to describe and evaluate patients experience about the App usage.

**Methods:** Starting from May 2021, patients with a compatible CIED with RPM capabilities were invited to download and install the App on a mobile device, at 14 Italian arrhythmia centers. In November, patients were asked to reply to an ad hoc questionnaire to describe and evaluate their experience.

**Results:** The App was proposed to 242 consecutive patients: 81 at implantation before RPM activation and 161 during follow-up, 79% male, 67% >50 years, 58% > secondary education level. 177 (73%) patients successfully installed the App, 49 (20%) declined, 12 (5%) did not have a suitable phone, 4 (2%) experienced technical problems precluding RPM activation. The App was installed by 127 (72%) patients and/or by a caregiver in the remaining cases. Installation problems were reported by 15 (8%) patients, and required telephone support in 12 cases. Notifications of lack of connection were received by 20 (11%) patients, and missed scheduled transmission by 22 (12%) patients. The median time from notification to resolution was 2 days (<1 week in 90%). At the time when the questionnaire was completed, 175 (99%) communicators were regularly transmitting data. The information received from the App were deemed clear and sufficient for the management and the installation of the communicator by 94% of patients. The App was judged useful or very useful for the verification of the monitoring status by 92% of respondents. Its use made 84% of patients feel reassured.

**Conclusion:** The App proved to be well accepted. It made patients feel reassured at home and offered support for communicator management and installation. Its use seems to result in very high continuity of monitoring.

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**PO-631-06**

**ARTIFICIAL INTELLIGENCE-ENABLED MODEL FOR EARLY DETECTION OF LEFT VENTRICULAR HYPERTROPHY AND MORTALITY PREDICTION IN YOUNG TO MIDDLE-AGED ADULTS**

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**Background:** Concealed left ventricular hypertrophy (LVH) is a prevalent condition that is correlated with a substantial risk of cardiovascular events and mortality, especially in the young to middle-aged adults. Early identification of LVH is warranted.

**Objective:** In this work, we aimed to develop an AI-enabled model for early detection and risk stratification of LVH using 12-lead electrocardiograms (ECGs).

**Methods:** By deep learning techniques on the ECG recordings from 28,745 patients (20-60 years old), the AI model was developed to detect verified LVH from transthoracic echocardiography and evaluated on an independent cohort. The LVH diagnoses were further correlated with future cardiovascular and all-cause mortality.

**Results:** The area under the curve (AUC) of the AI model in diagnosing LVH was 0.89 (sensitivity: 90.3%, specificity: 69.3%), which was significantly better than that of the cardiologists’ diagnosis (AUC: 0.64). In the second independent cohort, the diagnostic performance of the AI model was consistent (AUC: 0.86; sensitivity: 85.4%, specificity: 67.0%). After a follow-up of 6 years, AI-predicted LVH was independently associated with higher cardiovascular or all-cause mortality (hazard ratio: 1.91 and 1.54, respectively) (Figure 1). The predictive power of the AI model for mortality was consistently valid among patients with different ages, sexes, and comorbidities, including hypertension, diabetes mellitus, stroke, heart failure, and myocardial infarction.

**Conclusion:** The AI model improved the detection of LVH and mortality prediction in the young to middle-aged population and represented an attractive tool for risk stratification. Early identification by the AI model gives every chance for timely treatment to reverse adverse outcomes.

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**PO-631-07**

**A NOVEL METHOD FOR EXPLAINABLE DEEP NEURAL NETWORK-BASED INTERPRETATION OF ELECTROCARDIOGRAMS USING VARIATIONAL AUTO-ENCODERS: THE FACTORECG**

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**Background:** Deep neural networks (DNNs) show excellent performance in interpreting electrocardiograms (ECGs), even for novel applications such as detection of reduced ejection fraction (EF). Despite these promising developments, clinical implementation is hampered by the ‘black box’ nature of most algorithms and the lack of adequate explainability techniques. Especially, currently employed heatmap-based methods have shown to be inaccurate.

**Objective:** We aimed to develop a novel method, based on a variational auto-encoder (VAE), to identify the underlying factors of variation in the ECG and use them to develop an inherently explainable pipeline for automatic ECG interpretation.

**Methods:** We designed a β-VAE, that used the power of DNNs to learn to summarize the ECG in only 21 continuous factors (the FactorECG) by training on a database with 1.1 million ECG recordings (https://decoder.ecgx.ai). These factors are explainable through visualizations on both the model- and individual patient-level and are subsequently used in common and interpretable statistical methods. The predictive performance of the novel explainable DNN is compared to state-of-the-art ‘black box’ DNNs in three tasks: a conventional ECG interpretation task, detection of reduced EF and prediction of one-year mortality.

**Results:** The explainable DNN was able to compress the ECG into 21 generative ECG factors, which are associated with physiologically valid underlying anatomical and (patho)physiological factors. When applying the novel pipeline to the three tasks, the explainable DNN performed on par with the ‘black box’ DNNs in conventional ECG interpretation (AUC 0.94 vs 0.96), detection of reduced EF (AUC 0.90 vs 0.91) and prediction of one-year mortality (AUC 0.76 vs 0.75), while also providing explainability on which ECG features were important for prediction or diagnosis, in contrast to the ‘black box’ DNN (Figure 1).

**Conclusion:** Future studies should employ DNNs that are explainable by design to gain confidence in artificial intelligence and make it possible to identify biased models to facilitate better clinical implementation.