PHILIPS

Cardiologs

# Philips Cardiologs

Clinical validation and research

## This list of abstracts and peer-reviewed articles is provided to help healthcare professionals understand the current state of validation and research related to various AI algorithms developed by Philips Cardiologs and their potential applications.

Publications in sections 3 to 5 reflect research about algorithms that are under development and for investigational use only. These technologies are not products and may never become products.

The authors' conclusions are solely based on their scientific studies and must be evaluated by a medically qualified reader. Philips Cardiologs does not endorse conclusions contained in these publications.

## 1. Ambulatory ECG*


Fiorina, L., Maupain, C., Gardella, C., et al. Evaluation of an Ambulatory ECG Analysis Platform Using Deep Neural Networks in Routine Clinical Practice. Journal of the American Heart Association. 2022;11(18): e026196. DOI: 10.1161/JAHA.122.026196.

Fiorina, L., Marijon, E., Maupain, C., et al. AI-based strategy enables faster Holter ECG analysis with equivalent clinical accuracy compared to a classical strategy. EP Europace. 2020;22(suppl 1), euaa162.374. DOI: 10.1093/europace/euaa162.374.

Fiorina, L., Marijon, E., Maupain, C., et al. Artificial Intelligence Based Platform Enables Faster Ambulatory Electrocardiogram Analysis With Equivalent Clinical Accuracy Compared to Traditional Solution. Circulation. 2019;140(suppl 1), 9825. DOI: 10.1161/circ.140.suppl_1.9825.

Li, J., Rapin, J., Rosier, A., Smith, S.W., Fleureau, Y., Taboulet, P. Deep neural networks improve atrial fibrillation detection in Holter: first results. European Journal of Preventive Cardiology. 2016;23(2 suppl):41–55. DOI: 10.1177/2047487316668070.

## 2. Resting ECG†


Smith, S.W., Walsh, B., Grauer, K., et al. A deep neural network learning algorithm outperforms a conventional algorithm for emergency department electrocardiogram interpretation. Journal of Electrocardiology. 2019;52:88–95. DOI: 10.1016/j.jelectrocard.2018.11.013.

Smith, S.W., Rapin, J., Li, J., et al. A deep neural network for 12-lead electrocardiogram interpretation outperforms a conventional algorithm, and its physician overread, in the diagnosis of atrial fibrillation. IJC Heart & Vasculature. 2019;25:100423. DOI: 10.1016/j.ijcha.2019.100423.

Smith, S.W., Rapin, J., Li, J., et al. Improved interpretation of atrial dysrhythmias by a new neural network electrocardiogram interpretation algorithm. Academic Emergency Medicine. 2017;24:S235. DOI: 10.1111/acem.13203.


## 3. Smart devices‡


Fiorina, L., Chemaly, P., Cellier, J., et al. Artificial intelligence–based electrocardiogram analysis improves atrial arrhythmia detection from a smartwatch electrocardiogram. European Heart Journal - Digital Health. 2024;00:1–7. DOI: 10.1093/ehjdh/ztae047.

Lefebvre, B., Lehmann, H.I., Tordjman, D., Henry, C., Singh, J.P. Comparison of QT interval readings between smartwatch ECG combined with artificial intelligence and 12-Lead ECG in subjects hospitalized for antiarrhythmic drug initiation and follow-up. EP Europace. 2024:26(suppl 1), euae102.579. DOI: 10.1093/europace/euae102.579.

Mannhart, D., Lefebvre, B., Gardella, C., et al. Clinical validation of an artificial intelligence algorithm offering cross-platform detection of atrial fibrillation using smart device electrocardiograms. Archives of Cardiovascular Diseases. 2023;116(5):249–257. DOI: 10.1016/j.acvd.2023.04.003.

Fiorina, L., Lefebvre, B., Plesse, A., et al. High diagnostic accuracy of the detection of atrial arrhythmias from smartwatch electrocardiograms using a deep neural network. Archives of Cardiovascular Diseases Supplements. 2023;15(1):172. DOI: 10.1016/j.acvdsp.2022.10.326.

Mannhart, D., Lefebvre, B., Gardella, C., et al. Clinical validation of an artificial intelligence algorithm offering cross-platform detection of atrial fibrillation using smart device electrocardiograms. European Heart Journal. 2022;43(suppl 2), 2774. DOI: 10.1093/eurheartj/ehac544.2774.

Fiorina, L., Lefebvre, B., Gardella, C., et al. Smartwatch-based detection of atrial arrhythmia using a deep neural network in a tertiary care hospital. EP Europace. 2022;24(suppl 1), euac053.563. DOI: 10.1093/europace/euac053.563.

Maille, B., Wilkin, M., Million, M., et al. Smartwatch Electrocardiogram and Artificial Intelligence for Assessing Cardiac-Rhythm Safety of Drug Therapy in the COVID-19 Pandemic. The QT-logs study. International Journal of Cardiology. 2021;331:333-339. DOI: 10.1016/j.ijcard.2021.01.002.

Fiorina, L., Chemaly, P., Cellier, J., et al. An Artificial Intelligence-Based Smartwatch ECG Analysis Improves the Detection of Atrial Arrhythmia. Circulation. 2021;144(supply 1), 10175. DOI: 10.1161/circ.144.suppl_1.10175.

## 4. Digital biomarkers‡

Fiorina, L., Carbonati, T., Maille, B., et al. Back to the future: artificial intelligence-enabled single-lead ambulatory ECG can unmask conduction tissue disease. Heart Rhythm. 2024;21(5 suppl):S410, PO-03-010. DOI: 10.1016/j.hrthm.2024.03.1106.

Fiorina, L., Carbonati, T., Maille, B., et al. Artificial intelligence-enabled single-lead ECG can unmask conduction tissue disease. EHRA. April 2024.

Fiorina, L., Carbonati, T., Narayanan, K., et al. Near-term prediction of life-threatening ventricular arrhythmias using artificial intelligence-enabled single lead ambulatory ECG. Heart Rhythm. 2023;20(7):P1084, LB-456090-4. DOI: 10.1016/j.hrthm.2023.04.036.

Singh, J.P., Fontanarava, J.P., de Massé, G., et al. Short-term prediction of atrial fibrillation from ambulatory monitoring ECG using a deep neural network. European Heart Journal - Digital Health. 2022;3(2):208–217. DOI: 10.1093/ehjdh/ztac014ztac014.

Henry, C., Singh, J.P., Fontanarava, J., et al. Short term prediction of atrial fibrillation from ambulatory ECG using deep learning. Journal of the American College of Cardiology. 2022;79(9 suppl):2015. DOI: 10.1016/S0735-1097(22)03006-6.

## 5. Implantable devices‡

Mittal, S., Oliveros, S., Li, J., Barroyer, T., Henry, C., Gardella, C. AI filter improves positive predictive value of atrial fibrillation detection by an implantable loop recorder. JACC Clinical Electrophysiology. 2021:7(8):965–975. DOI: 10.1016/j.jacep.2020.12.006.

Mittal, S., Oliveros, S., Henry, C., Li, J., Gardella, C. An artificial intelligence-based solution to reduce false positive detections of atrial fibrillation by an implantable loop recorder. Heart Rhythm. 2020;17(5 suppl):S68, D-AB25-06.

* Philips Cardiologs AI algorithms for Ambulatory ECG analysis are used in the Cardiologs Holter platform. The Cardiologs Holter Platform is a medical device intended for use by qualified healthcare professionals for the assessment of arrhythmias using ECG data. It is CE marked and cleared by the FDA under 510(k).

† Philips Cardiologs AI algorithms for Resting ECG analysis are for investigational use only in the US. They are not commercially available today in the US. Refer to your commercial representative to check availability in your region.

‡ Philips Cardiologs AI algorithms for analyzing data from smart and implantable devices, as well as ECG biomarkers, are for investigational use only. They are not commercially available today and may never become products. They are not cleared or approved by the US FDA or any other global regulator for commercial availability.