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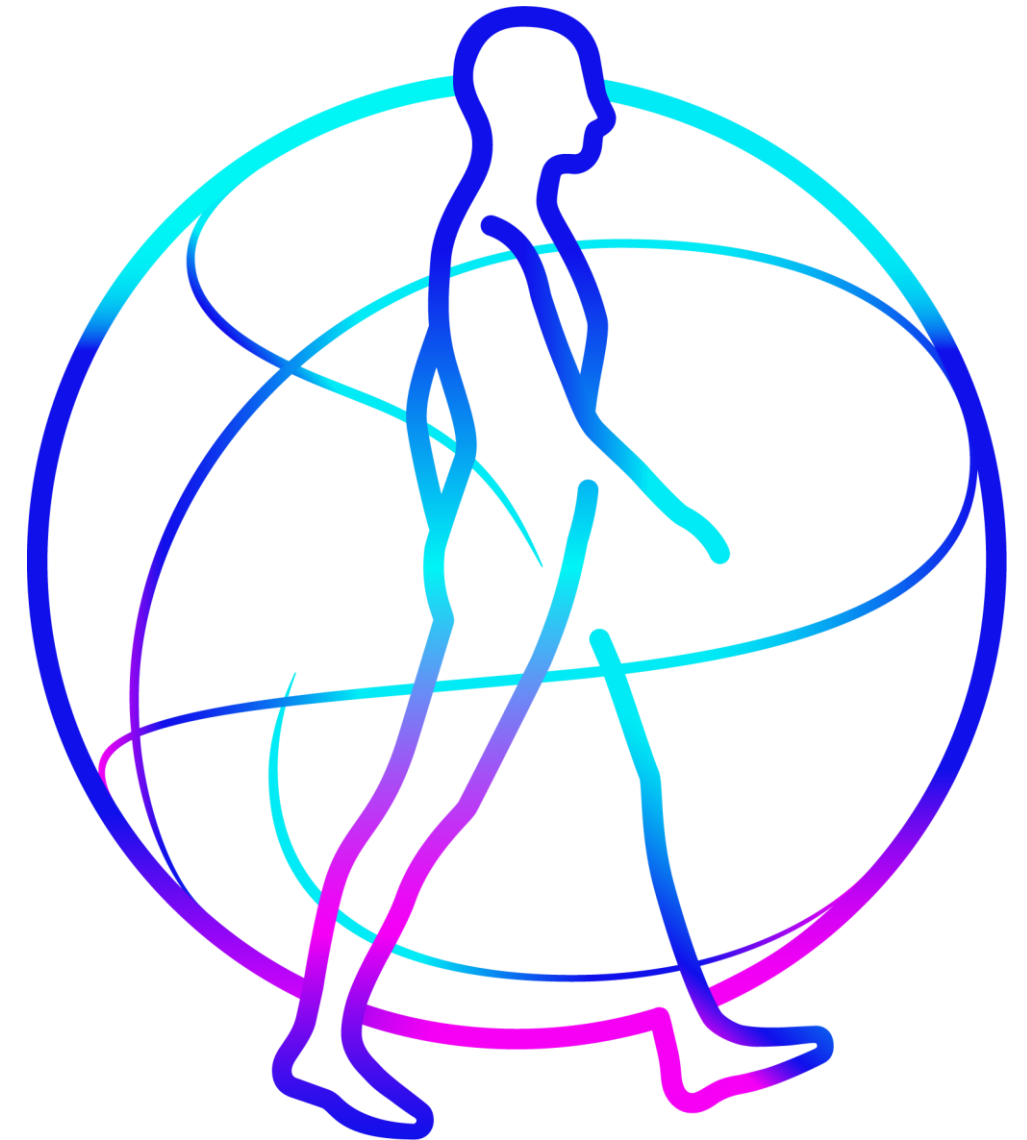
Engineering the extraordinary

Predetermined Change Control Plans

Supporting Efficient Regulatory Oversight of AI-Enabled Products
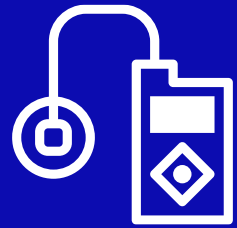
February 2024

# Machine learning and artificial intelligence in medicine

Offering potentially revolutionary capabilities

Use of AI-enabled medical devices has potential to address some of the most critical challenges in healthcare

With dramatic increase in connected devices and electronic health record data, there is increased opportunity to understand and treat patients as well as increased burden on physicians
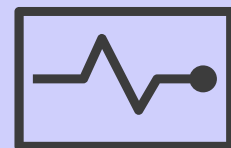
AI techniques, if leveraged responsibly, offer the opportunity to provide meaningful insight driven care

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Overview: AI-enabled medical devices

- AI-enabled medical devices are medical devices and should be regulated through **existing regulatory frameworks**

- Should be regulated **based on intended use and the risk of product**

- Regulatory framework should **evolve to meet iterative aspects** of AI-based technologies

- Predetermined Change Control Plan (PCCP) is an **innovative approach** to **further iterative improvements** in medical devices

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Predetermined change control plans: Enabling more rapid improvements

Option to submit with initial premarket submission a plan for specific future postmarket modifications and methods to achieve and control any risks associated with those changes

PCCP components (from U.S. FDA guidance)

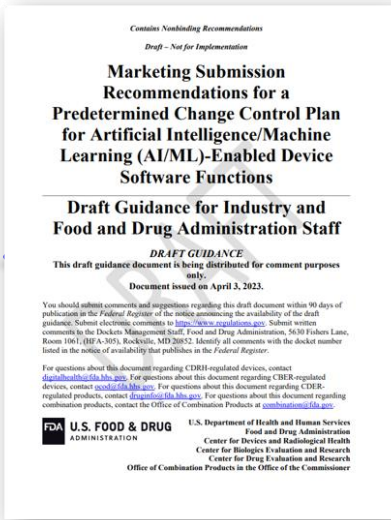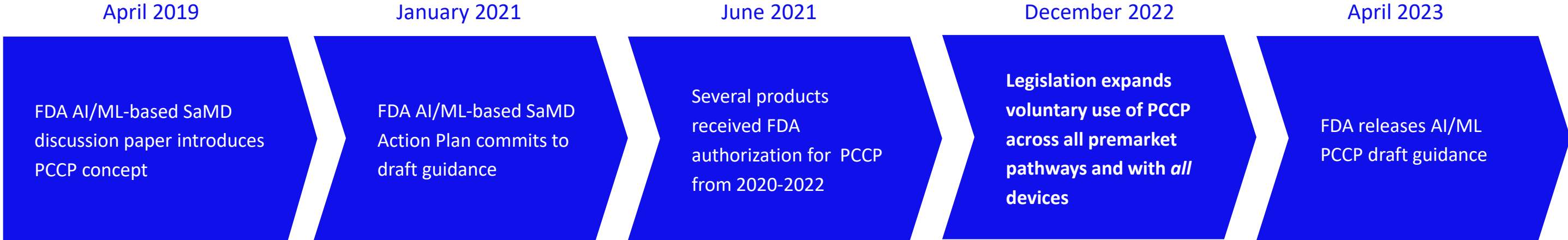Description of Modifications

Modification Protocol

Impact Assessment

After authorization, can make identified modifications while still ensuring safety & effectiveness of device

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Case Study:
Experience with PCCP

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U.S. experience: Expanding use of PCCPs across all products

April 2019

FDA AI/ML-based SaMD discussion paper introduces PCCP concept

January 2021

FDA AI/ML-based SaMD Action Plan commits to draft guidance

June 2021

Several products received FDA authorization for PCCP from 2020-2022

December 2022

Legislation expands voluntary use of PCCP across all premarket pathways and with *all* devices

April 2023

FDA releases AI/ML PCCP draft guidance

! PCCP no longer limited to AI/ML-enabled devices

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Overview of Design Concept

AI ECG Classification System – Reduce Number of False Positives During Monitoring

Insertable cardiac monitor (ICM) system notifies clinic of observed arrhythmia events

- False episodes and associated follow-up increases burden, and sometimes concern, on patients unnecessarily

- AI-enabled tool designed to reduce number of false positives for most common episodes (AF and Pause), while maintaining sensitivity for true positive events

Design solution: AI ECG Classification System

- Includes two new AI algorithms to adjudicate AF and Pause episodes detected by ICM

- Provides a layer of technology in the cloud to determine if device-collected arrhythmia episodes are false positives

- Preserves high sensitivity while reducing false positives

- Decreases data review burden on the clinician

- **Algorithms are locked**, not continuously learning / adapting in real-time

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Performance Results

AI ECG Classification System – Performance of 1st Generation Solution

AF & Pause generate ~90% of ICM false alerts

97.4% reduction in false Pause alerts

74.15% reduction in false AF alerts
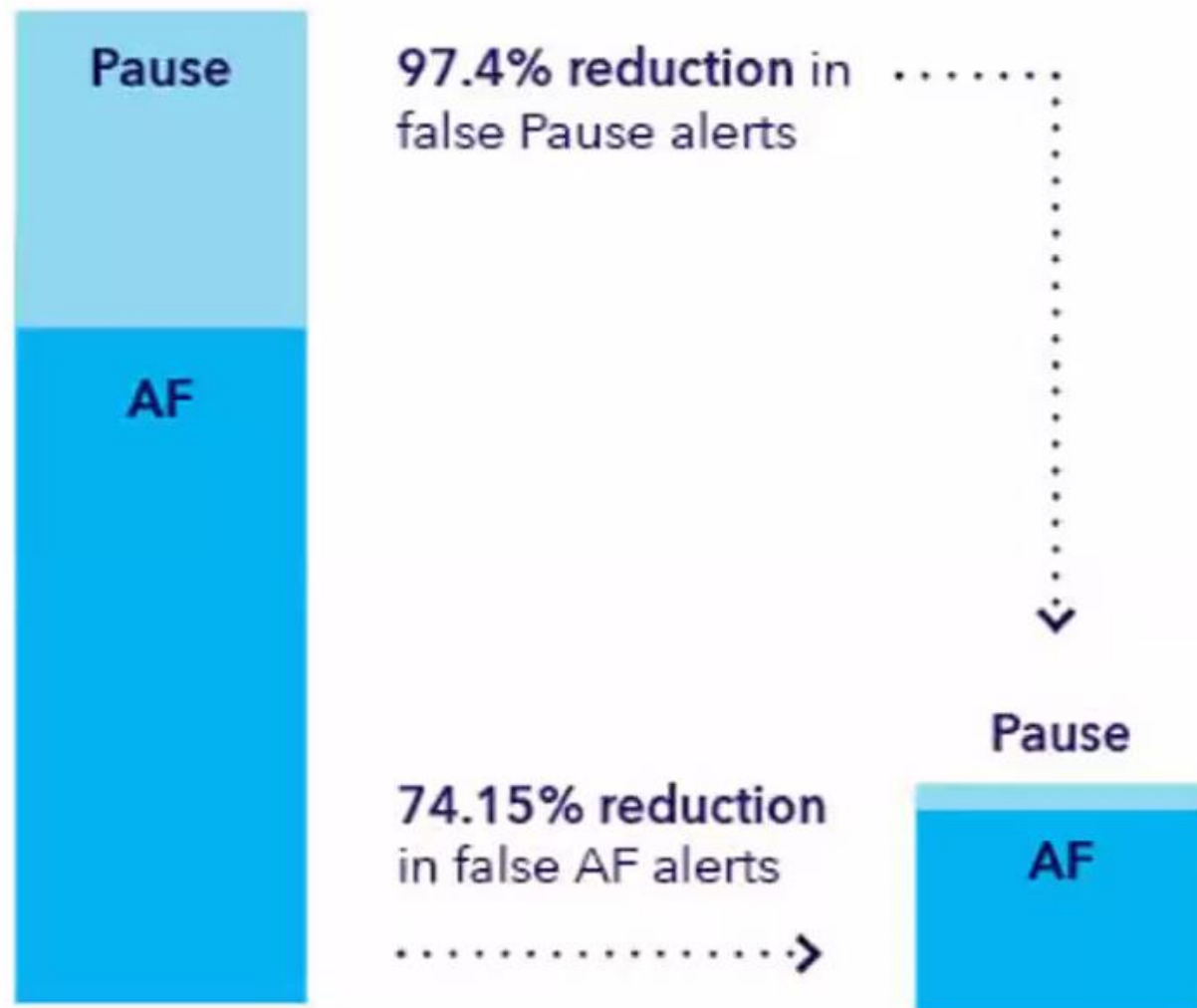
- 84% combined false alert reduction

- 319 hours reduction in clinic review time for every 200 patients

- Retained sensitivity:
  - AF Algorithm: 99.93% preserved true alerts
  - Pause Algorithm: 100% preserved true alerts

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Predetermined Change Control Plan

Leveraged FDA's PCCP regulatory framework for AI-enabled products

- PCCP was a robust plan. Provided sufficient detail in PCCP to allow FDA to make determination on the impact of safety and effectiveness as a result of the specific changes.
- Included:
  - "**What will be changed**?" Providing specific modifications to FDA in PCCP submitted with regulatory submission
  - "**How will it be validated**?" Described the methods that will be followed to validate the specific modifications

Obtained FDA authorization with authorized PCCP
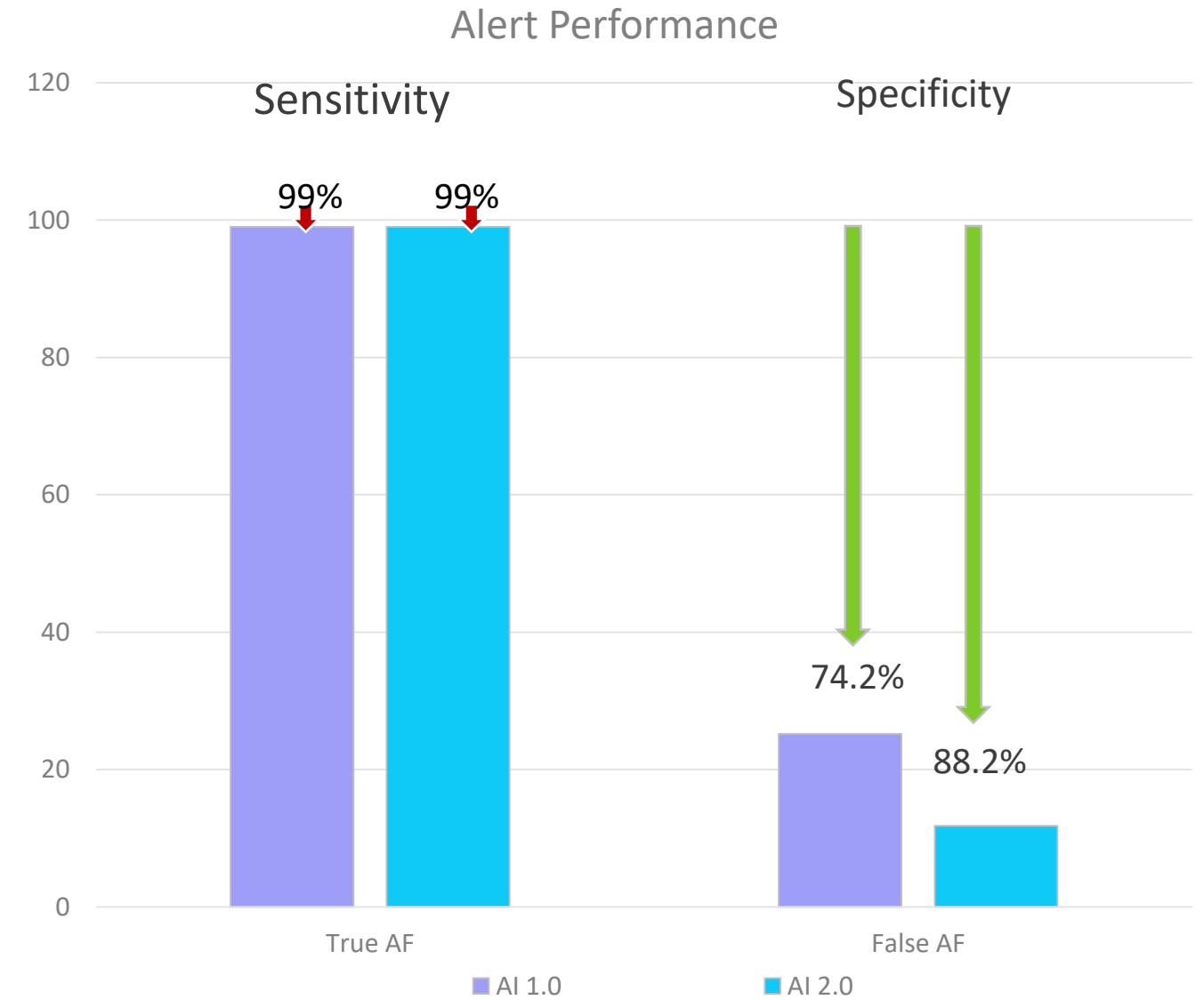
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AI AF Algorithm version 2.0

Performance after following PCCP, including development and testing plan

Alert Level Performance

99% True AF Retained

(equivalent to version 1.0)

88% False AF Suppressed

(53% decrease from version 1.0)

Alert Performance

	Sensitivity	Specificity
	99% 99%	74.2% 88.2%

True AF   False AF

■ AI 1.0   ■ AI 2.0

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Commitment to Transparency

AI ECG Classification System

Users

- Healthcare Providers, such as EPs and Nurses, who remotely manage their patients

Initial Launch

- Prior to launch, researched right level of detail for training and education to explain new feature and address concerns users might have in AI technology and its performance
- Created training and educational content and deployed in several formats – YouTube videos, presentations, brochures, website
- Performance reports are available to show alert reduction and time savings, if requested by a clinic
- Opportunity to review the original data if users wish to see the data for themselves

Changes Over Time

- PCCP included an explicit plan element addressing how changes would be communicated to users
- Communication is provided to notify users when a new version has been deployed and leverages all the initial launch work
- Content includes a description of changes, impact on performance, clinician workflow and experience, and a reference to the updated manual

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Key Take-Aways

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PCCP benefits & considerations

Allows manufacturer to make specific modifications postmarket without new marketing authorization, **furthering more rapid positive product evolution & improvements for patient care**

Reduces burden for regulators by **reducing total number of reviews** for a product.

Modifications included in PCCP should be those that would **otherwise require premarket review**. Can be utilized for modifications implemented manually or automatically

Goal is a **harmonized regulatory approach** that strikes a balance of sufficient premarket confidence and postmarket efficiency

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Thank you

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