

# A Digital Health Decision Support Eco-System for Standardized Atrial Fibrillation Care

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# Background

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- Atrial Fibrillation (AF) is a common sustained arrhythmia
  - 1-2% of the population in the developed world
  - 250-400K Canadians; 10-20K Nova Scotians
- Knowledge gaps exist in AF management
  - Lack of use of efficacious anti-coagulant drug therapies
  - Uncertainty and variance about when/how to treat rhythm/rate
  - Serious adverse effects → Stroke
- Long-term AF patient care is sub-optimal
  - Lack of patient monitoring
  - Lack of adverse event detection and timely response
  - Lack of oversight by physicians
  - Lack of engagement of patients in the care process (self-management)

# Rationale for IMPACT-AF

Among community-based patients with AF, does providing an integrated Clinical Decision Support System (CDSS) to providers and patients improve process of care and clinical outcomes, and, decrease healthcare costs and resource utilizations over 12 months, as compared to usual care?



IMPACT-AF: Innovative Management Program Advancing  
Community Treatment of Atrial Fibrillation

**New Model of Chronic Disease Management Supported by  
Innovative Digital Health Solutions and Technologies**



# IMPACT-AF: Digital Health Inspired Chronic Disease Management

## EMPOWER

Primary Care Physicians

- Knowledge translation
- Clinical decision support
- 24x7 AF risk monitoring
- Clinical guideline based AF management

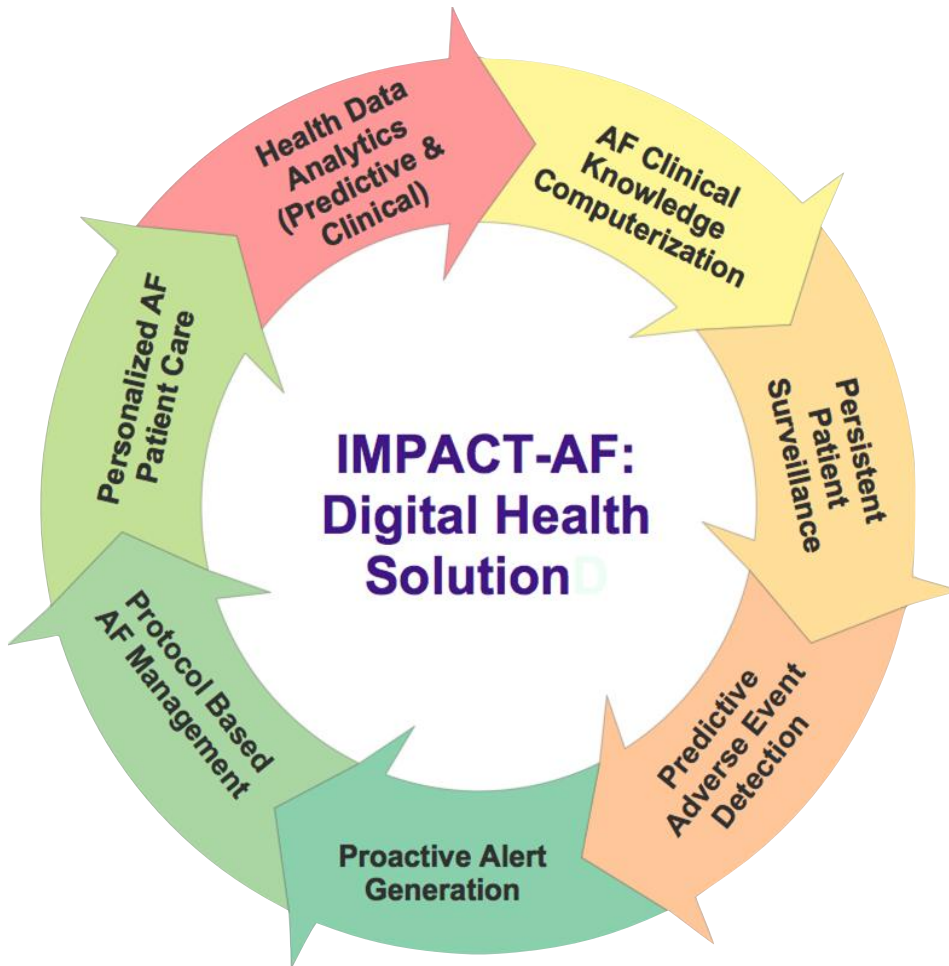
## ENGAGE

Patients

- AF status self-reporting
- Personalized alerts/reminders
- Decision aids for self-management
- Behaviour modification



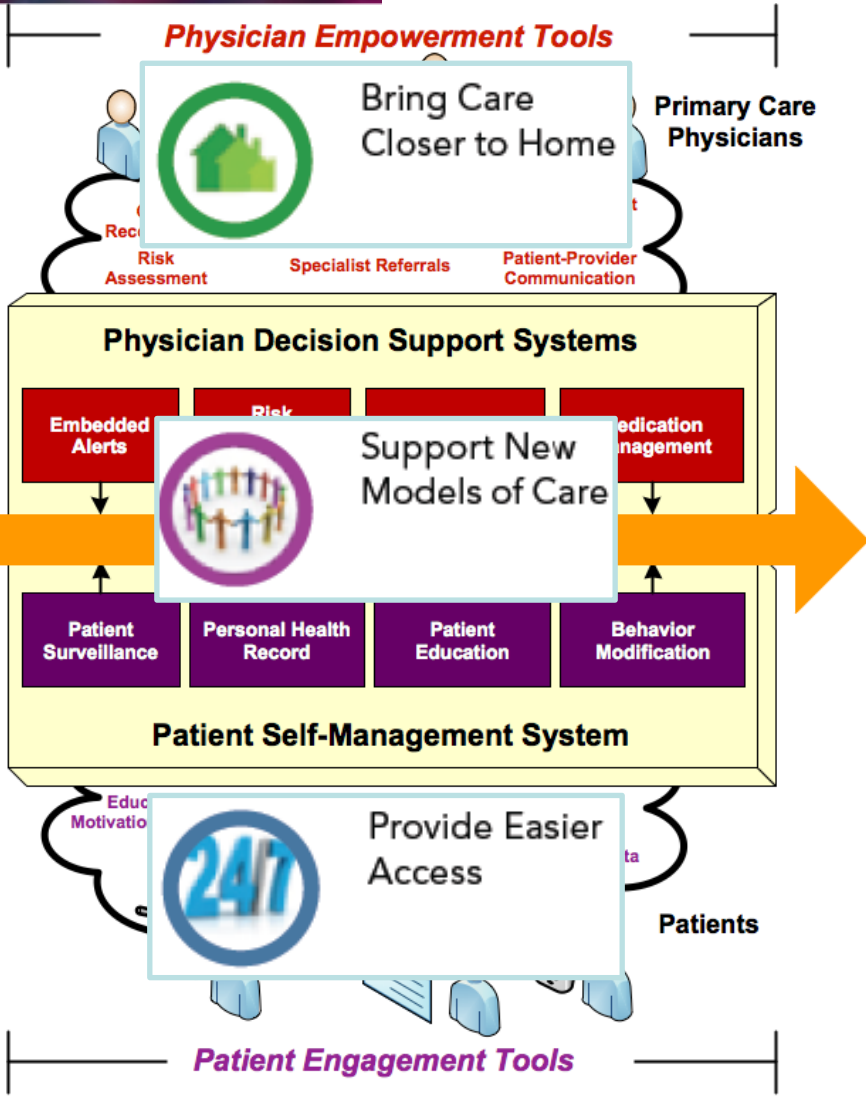
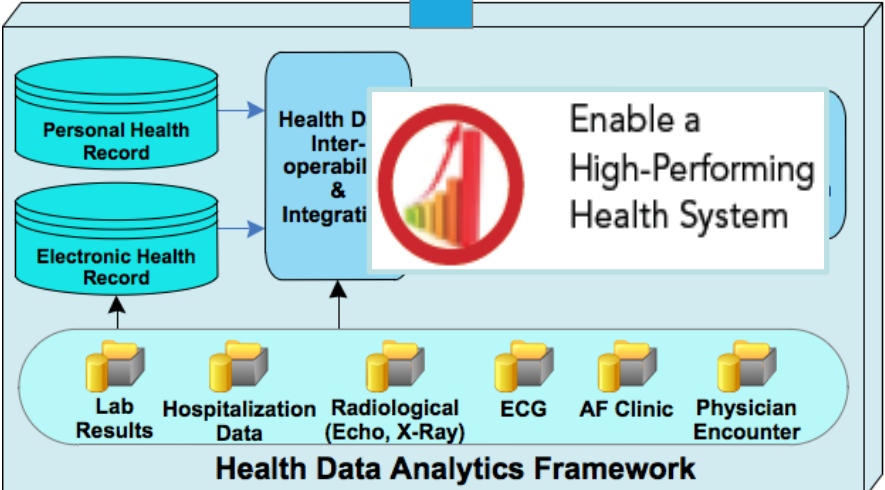
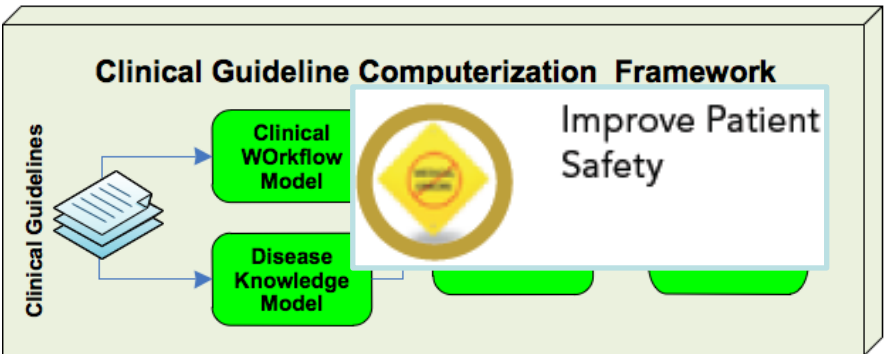
# IMPACT-AF Solution Approach



- **Knowledge Translation** → *Computerization of AF Guidelines*
- **Knowledge Execution** → *Clinical Decision Support System*
- **Patient Engagement** → *Mobile Patient Diary*
- **Physician AF Management** → *Physician Dashboard*
- **Personalized Medicine** → *Health Data Analytics*



# IMPACT-AF Eco-System



# IMPACT-AF Eco-System

IMPACT-AF Physician and Patient Interface  
Website and Mobile Devices (Android & iOS)

Labs

ED

Hosp

AF  
Clinic

Data Interfaces

AF Diary and Self-Management Strategies  
(Patients)

AF Medication (NOAC) Prescription Aids  
(Physicians)

AF Clinical Decision Support System  
(Physicians)

Data Analytics  
and Visualization

Patient Data Services

AF Guideline Computerization

CRF

Patient  
AF Record

Operational  
Intelligence

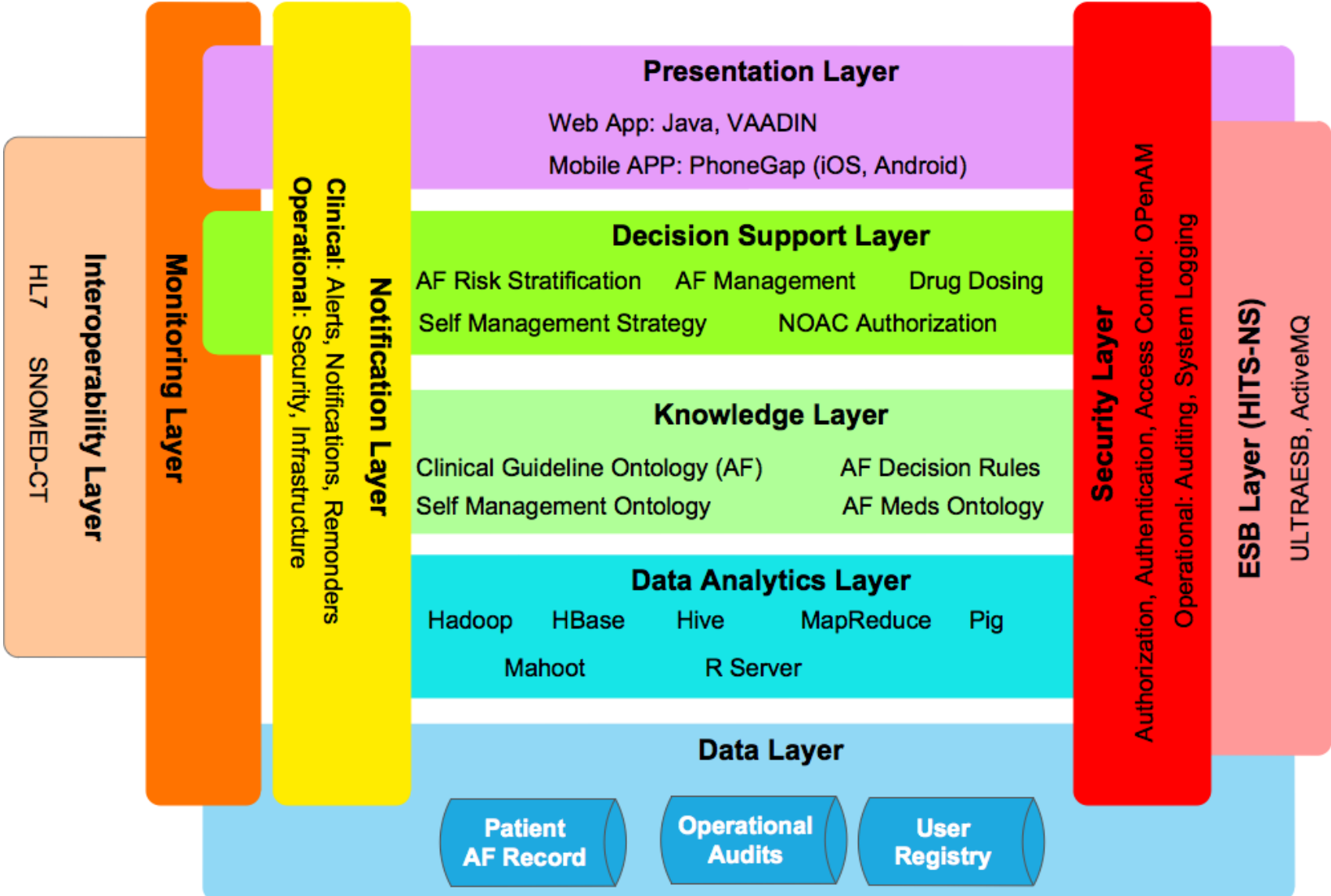
AF Mgmt.  
Rules

AF  
Guidelines

Dosing  
Algorithms

NSHA (Server Infrastructure, Privacy, Security)

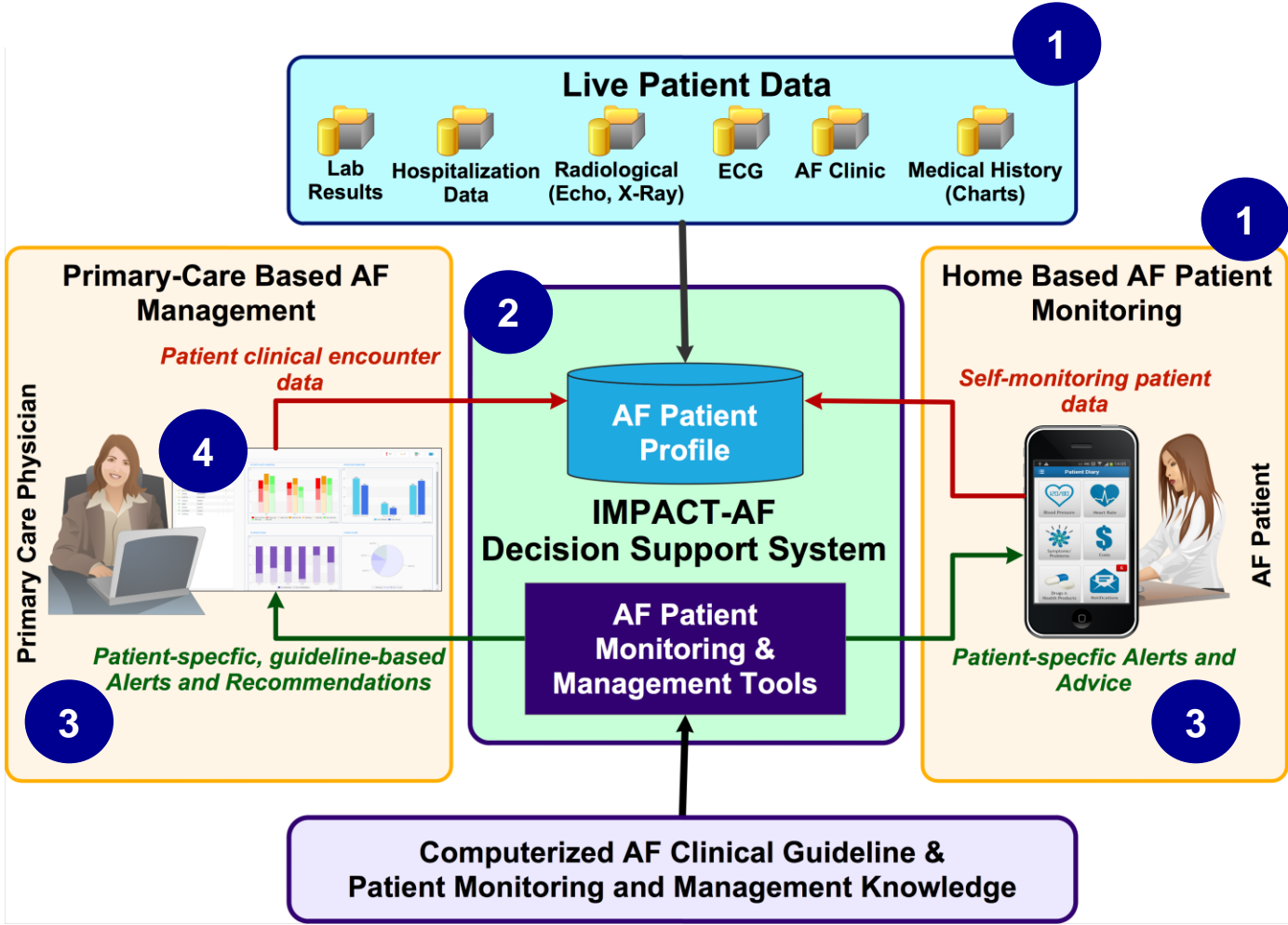
# IMPACT-AF Eco-System Architecture





# IMPACT-AF in Operation

- 1. Monitor**  
Pervasive patient surveillance
- 2. Analyze**  
Patient's evolving AF profile
- 3. Respond**  
Proactive alerts to physicians and patients
- 4. Manage**  
Personalized AF care based on clinical guidelines





## Welcome to **IMPACT-AF!**


A knowledge translation approach to improving care and health outcomes for people with atrial fibrillation.


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 [Contact Us](#)



 Study ID (Patients) or Email (Providers)

 Password

 Sign In

[Need help!](#)

# Physician's Perspective: Patient Management

**MY AF PATIENTS**

Back to My Dashboard

TR	First	Last	A.	N.	R.
	Michel	Underwood	15	4	1
	Julle	Chase	5	1	1
	Julia	Heywood	5		
	Mary	Patient	3	1	
	Jessica	Al	8		
	Alex	Watters			
	Arya	Stark			
	Ashley	James			
	Cyrus	Owens			
	Dave	Lis			
	David	Menias			
	Jennifer	Aniston			
	John	Relly			
	Julia	Brown			
	Mania	Seri			
	Medow	Soprano			
	Morgan	Freeman			

**LATEST AF OVERVIEW (MICHEL UNDERWOOD)**

Click to open the "AF-MANAGEMENT" page

Age: 75  
Weight: 80 kg  
CHADS2: 6 → 18.2% annual stroke risk  
CHA2DS2-VASc: 9  
HAS-BLED: 6 → 19.4% annual bleeding risk  
eGFR: 21 ml/min (2016-01-20)  
Creatinine Clearance: 40.36 ml/min (2016-02-02)  
INR: 4 (2016-01-21)  
TTR (Last 2 months): 0.0 %

Latest ECG: 2016-01-21 Rhythm: Sinus  
Latest LV Function: 2016-01-18  
Latest Hospitalization: 2016-01-18  
Latest ED Visit: 2016-01-18  
Latest Blood Work: 2016-01-27  
Latest DSS Run: 2016-02-01  
Current Medications: 2 (2016-02-01)  
Symptoms & Complications: 9 (2016-02-01)  
Medical History: 12 Condition(s)

**BLOOD PRESSURE**

Date	Systolic	Diastolic
Jan 22	250	150
Jan 25	150	100
Jan 25	190	110
Jan 25	170	100
Jan 25	160	100
Jan 25	130	80
Jan 26	170	55
Jan 27	50	50
Jan 27	150	100
Feb 01	60	50

**HEART RATE**

Date	Heart Rate
Jan 22	250
Jan 25	185
Jan 25	180
Jan 25	110
Jan 25	140
Jan 25	95
Jan 27	15
Jan 27	150
Feb 01	280
Feb 01	55

**INR**

Date	INR
Oct 30	5
Nov 04	3.8
Nov 05	1
Nov 05	2
Nov 05	3
Nov 16	1
Jan 18	3
Jan 18	4
Jan 21	16
Jan 21	4

**eGFR**

Date	eGFR
Oct 18	15
Oct 19	20
Oct 19	21
Jan 01	1
Jan 05	3
Jan 13	2
Jan 15	6
Jan 17	2.8
Jan 19	4.5
Jan 20	21

# Physician's Perspective: Decision Support

NEW ALERTS: [Michel Underwood \(Study ID: 126495982\)](#)

PLEASE ATTEND TO THE BELOW ALERTS		
Alert	Active for (Days)	Created at
▶ <b>MEDICATION (15)</b>		
▼ <b>CONSIDERATION (16)</b>		
▶ The patient might have anemia. (3)	1	2015-10-28 14:52:34
The patient might have an uncontrolled h ...	1	2015-10-28 14:52:34
The patient might have hypothyroidism.	1	2015-10-28 14:52:34
The patient might have hyperkalemia.	1	2015-10-28 14:52:34
▶ The patient might be at risk of bleeding ... (8)	1	2015-10-28 14:52:34
The patient might have hyponatremia.	1	2015-10-28 14:52:34
The patient is at an increased risk of s ...	8	2015-10-20 22:39:23
▶ <b>ABNORMAL CONDITION (4)</b>		

### Consideration Alert

High Priority

Active for: 8 day(s)  
Created at: 2015-10-20 22:39:23

**Recommendation:** The patient is at an increased risk of stroke. Unless contraindicated, OAC therapy should be initiated. Canadian AF management guidelines recommend that a NOAC be prescribed in preference to warfarin.

**Reasoning:**

- Reason # [1]: The patient's age is greater than or equal to 65 and is not currently on OAC.
- Reason # [2]: The patient has had a prior stroke or TIA and is not currently on OAC.
- Reason # [3]: The patient has diabetes and is not currently on OAC.
- Reason # [4]: The patient has heart failure or left ventricular dysfunction and is not currently on OAC.
- Reason # [5]: The patient has hypertension and is not currently on OAC.

Actions:

Accept

Override

Ignore

Comment

250 Character(s) left

Options:

⚙️ Recommendation Justification

✉️ Contact Patient

Tools:

📊 Warfarin Dosage Calculator

📄 NOAC Authorization

# Physician's Perspective: Medication Management

NOAC AUTHORIZATION FOR MICHEL UNDERWOOD

NOAC AUTHORIZATION FOR MICHEL UNDERWOOD

## NOVA SCOTIA PROVINCIAL PHARMACARE PROGRAMS

Request for Coverage of Dabigatran (Pradaxa®), Rivaroxaban (Xarelto®), or Apixaban (Eliquis®)

Step 1: Information      Step 2: Result

- **AF Patient (Non-Valvular AF)**
- Age: 75
- Gender: FEMALE
- Weight: 87.0 (kg)
- CHADS2: 6
- CHA2DS2-VASC: 9
- HAS-BLED: 6
- Creatinine: 10.0
- Creatinine Clearance: 588.12
- TTR: 100.0
- Prior Stroke: ✓
- TIA: ✓
- Hypertension: ✓
- Diabetes: ✓
- Heart Failure: ✓
- Labile INRs: ✗
- OAC is recommended

- hemorrhage
- Hepatobiliary disorders: jaundice, cholestasis, cytotoxic hepatitis
  - Nervous system disorders: Intra-axial hemorrhage (ICH)\*, subdural hematoma, epidural hematoma, hemiparesis
  - Skin and subcutaneous tissue disorders: Stevens-Johnson syndrome

PATIENT INFORMATION			
PATIENT SURNAME Underwood	PATIENT GIVEN NAME Michel	HEALTH CARD NUMBER 123456789	DATE OF BIRTH May/1940
PATIENT ADDRESS 6050 University Ave, Halifax NS, B3H4R2			
DOSE REQUESTED			
<input type="checkbox"/> Pradaxa® 110mg bid	<input type="checkbox"/> Pradaxa® 150mg bid	<input type="checkbox"/> Xarelto® 15mg once daily	<input checked="" type="checkbox"/> Xarelto® 20mg once daily
<input type="checkbox"/> Eliquis® 2.5mg bid	<input type="checkbox"/> Eliquis® 5mg bid		
DIAGNOSTIC INFORMATION			
<b>DIAGNOSIS:</b>			
1. <input type="checkbox"/> Treatment of DVT without symptomatic pulmonary embolus (Xarelto only). Usual dose: 15mg twice daily for three weeks then 20mg once daily. Coverage duration: 6 months			
2. <input checked="" type="checkbox"/> Non-valvular atrial fibrillation (AF) <input checked="" type="checkbox"/> CHADS <sub>2</sub> score: 6			
Creatinine clearance [CrCl]: 588.12 mL/min      Date 2015/10/28			
<b>Selected notes regarding dosing in AF (Refer to monograph for complete dosing information):</b>			
<b>Pradaxa dosing:</b> - Usual dose 150mg bid - CrCl ≤ 30 mL/min: use is contraindicated	<b>Xarelto dosing:</b> - Usual dose 20mg once daily - CrCl ≤ 30mL/min: use is contraindicated	<b>Eliquis dosing:</b> - Usual dose 5mg bid - CrCl ≤ 25mL/min: use is contraindicated	
<b>Agents Tried:</b>		<b>Dose, length of therapy &amp; outcome:</b> (i.e., inadequate anticoagulation*, etc.)	
<input type="checkbox"/> Warfarin		_____	
<input type="checkbox"/> Other _____		_____	
* Please provide the percentage of INR testing results that are outside the desired INR range.			
If warfarin has not been tried, please indicate the reason why:			
<input checked="" type="checkbox"/> Warfarin contraindicated <b>Warfarin Allergy</b>			
<input type="checkbox"/> Other _____			
PHYSICIAN NAME & ADDRESS: <b>Dr. Alex Lopez</b>		Digitally Signed by: Alex Lopez CPAP-995801 email=alex.lopez@nspharmcare.com Date: 2015-10-28	
995801 CPSNS #		2015/10/28 DATE	

If you need assistance, please contact the Pharmacare Office at (902) 496-7001 or 1-800-305-5026

Please Return Form To: Nova Scotia Pharmacare Programs  
P.O. Box 500, Halifax, NS B3J 2S1  
Fax: (902) 468-9402

12/2013



Dabigatran (Pradaxa®)

10 mg BID OR strongly consider another NOAC

SAVE THE RESULT

# Patient's Perspective: Patient AF Diary

Michel Underwood's Dashboard (Study ID: 126495982)

[PATIENT SUMMARY](#)
[AF MANAGEMENT](#)
[MEDICATIONS](#)
[LAB/TEST RESULTS](#)
[ALERTS](#)
[PATIENT DIARY](#)

[Alerts](#)
[Notifications](#)
[Vital Signs](#)
[Blood Work](#)
[Emergency Department](#)
[Hospitalization](#)
[ECG](#)
[LV Function](#)
[New Drugs](#)
[Changed Drugs](#)

[Overview](#)

**February 2016**

2
 2

HAS-BLED: 6      CHADS2: 6  
 CHA2DS2-VASc: 9      TTR: 0%

[Scores](#)    [Other](#)

**January 2016**

71
 3
 19
 9

1
 1
 2
 1

18
 2

HAS-BLED: 6      CHADS2: 6  
 CHA2DS2-VASc: 9      TTR: 0%

[Scores](#)    [CDSS](#)    [Other](#)

**December 2015**

5
 1
 2
 3

HAS-BLED: 1      CHADS2: 1  
 CHA2DS2-VASc: 4      TTR: 0%

[Scores](#)    [Other](#)

**November 2015**

9
 5
 6
 1

[Other](#)

**October 2015**

5
 3
 7
 1

1

[Other](#)

**September 2015**

1
 1
 1
 1

[Other](#)

**August 2015**

17
 7
 8

[Other](#)

**July 2015**

2
 3
 1
 1

[Other](#)

**June 2015**

2
 3
 4
 1

3

[Other](#)

**May 2015**

7
 1
 1
 1

1

[Other](#)

**April 2015**

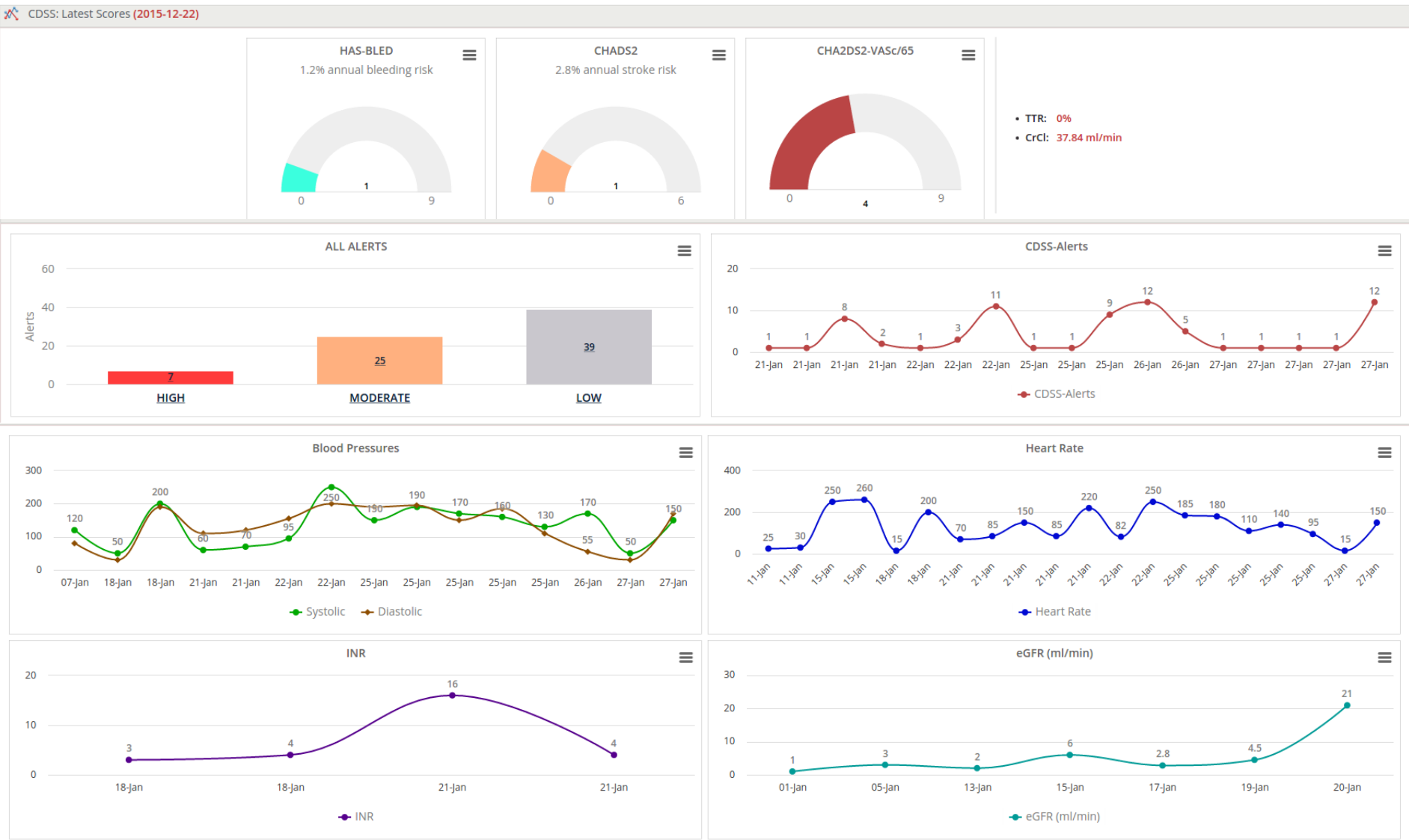
2
 7

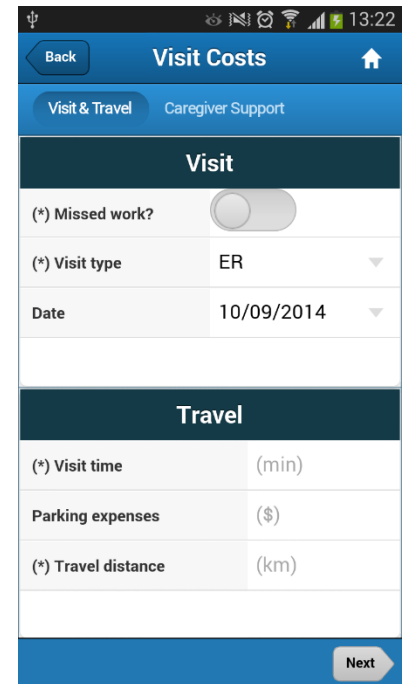
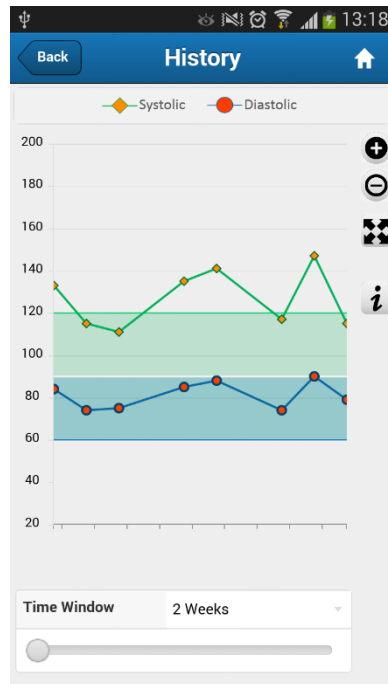
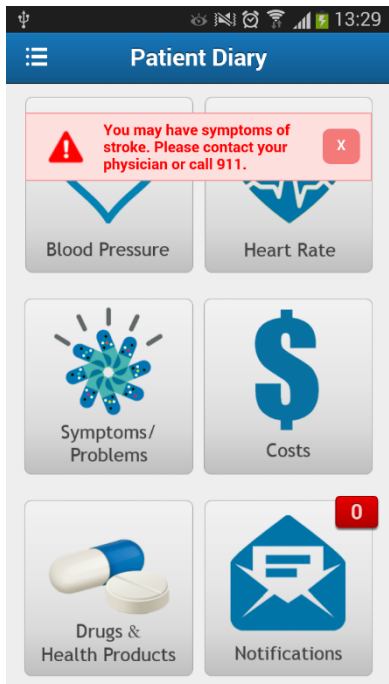
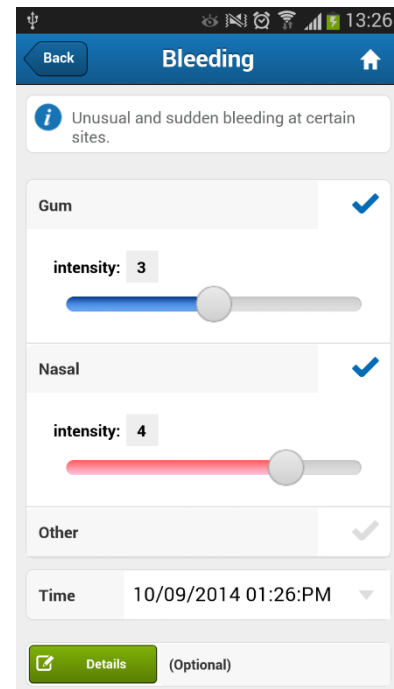
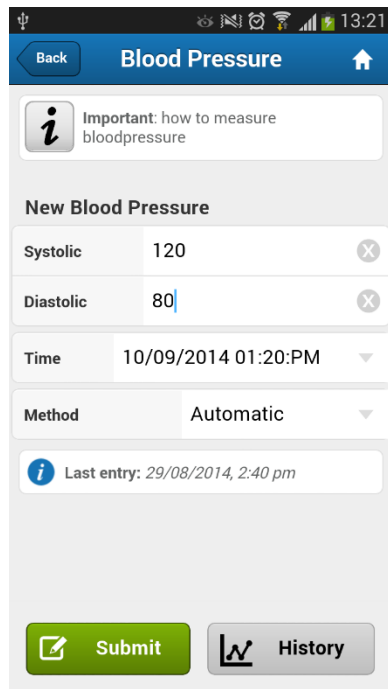
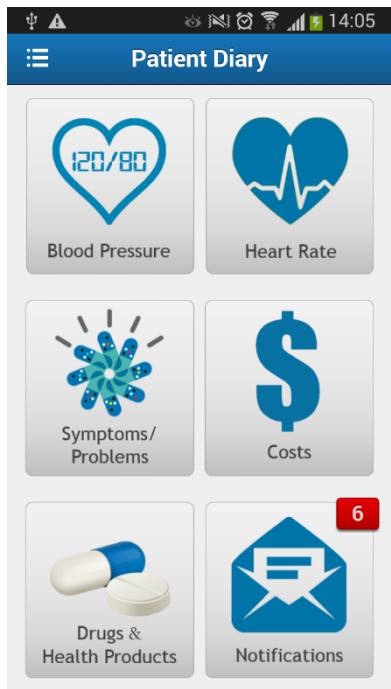
**March 2015**



# Patient's Perspective: Risk Assessment

Michel Underwood (December 2015)





# IMPACT-AF: Study Objective

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*Among community-based patients with AF, does providing an integrated Clinical Decision Support System (CDSS) to providers and patients improve process of care and clinical outcomes, and, decrease healthcare costs and resource utilizations over 12 months, as compared to usual care?*

- ❖ Cluster randomized (provider level; urban / rural)
- ❖ 200 Primary Care Providers
  - ❖ Internet Access required; minimum 15 patients with AF
  - ❖ 50% Intervention, 50% Usual Care
- ❖ 2,000 AF patients
  - ❖ Confirmed AF, English speaking,  $\geq$  18 years of age
  - ❖ Only patients of participating primary care providers
- ❖ 12 month follow-up
- ❖ Comparison with specialist AF Clinic

# IMPACT-AF: Study Outcomes

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## 1<sup>0</sup> study outcome

CV hospitalization

## 2<sup>0</sup> study outcomes

### a. Process of Care

Access to specialist consultation, echo, catheter ablations

### b. Clinical

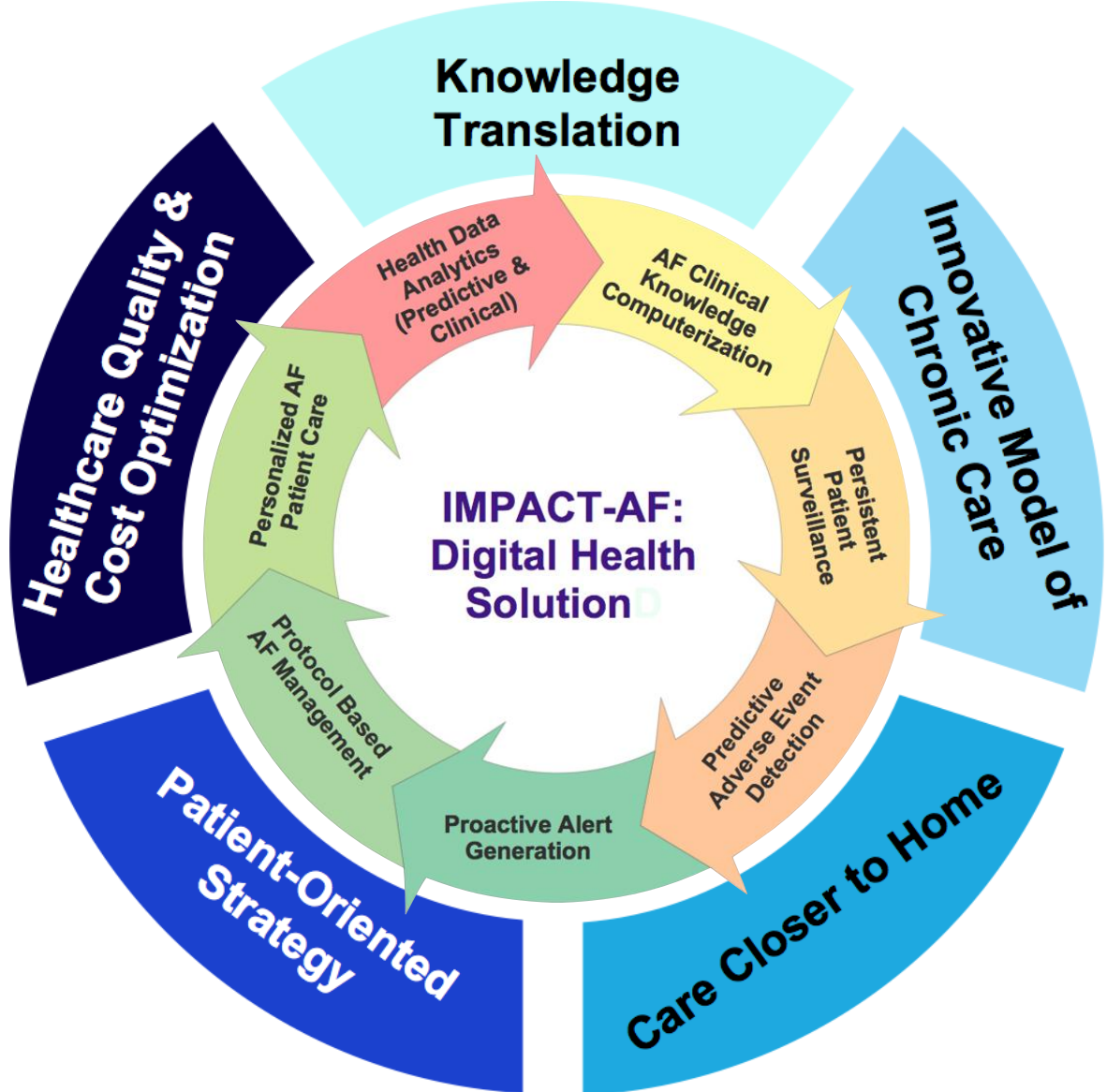
Mortality; ED visits; Appropriate anticoagulant therapy

### c. Quality of Life / Cost effectiveness

Health Related QoL

Costs of CDSS / AF care

# IMPACT-AF: A Paradigm Shift in Chronic Disease Management



# Acknowledgements

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# Thank You

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The one constant is change!

