Using Mobile-Based Technology to Screen for Atrial Fibrillation in India

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Disclosure

I have no actual or potential conflict of interest in relation to this presentation
Pathophysiology of Atrial Fibrillation

1. The sinus node, the heart's natural pacemaker, triggers every heartbeat by sending an electrical signal.

2. ...to both atria (top chambers of the heart). The atria contract and pump blood into the ventricles (bottom chambers of the heart).

3. The atrioventricular node is the "gateway" between the atria and ventricles. It controls the flow of electrical signals to the ventricles and can slow down these electrical signals if necessary.

4. The two branches of the bundle of His (special heart muscle cells) help to conduct the electrical signals to the walls of the ventricles.

When the heart beats in a normal rhythm (known as 'sinus rhythm'), blood flows freely through its chambers.
Pathophysiology of Atrial Fibrillation

Risk Factors:
- Increasing age
- Hypertension
- Diabetes
- Valvular disease
- Previous MI
- Heart surgery
- Thyroid problems
- Sleep apnea
- Alcohol use
- Genetic disposition
Pathophysiology of Atrial Fibrillation

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Progression of Atrial Fibrillation
Atrial Fibrillation: Why do we care?

In the US the prevalence is projected to be more than doubled by 2050.

- Today: 5.1 million
- 2050: 12.1 million

One in four adults aged over 40 develops AF in their lifetime.

Atrial fibrillation and the risk of stroke.

NORMAL HEART

Normal Heart

ATRIAL FIBRILLATION

Atrial Fibrillation

Stroke

5x Increase
Atrial Fibrillation: Why do we care?

- Accounts for one-third of all strokes
- Stroke is often the first “symptom”
- Stroke caused by atrial fibrillation is more debilitating and lethal
Atrial Fibrillation: Why do we care?

- Accounts for one-third of all strokes
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Anticoagulation treatment among people with atrial fibrillation can reduce stroke risk by 2/3 and mortality risk by 1/3
Conventional Wisdom about Global Epidemiology of Atrial Fibrillation

Results from “The Lancet Global Burden of Disease Study 2010” – A Systematic Review

Chugh, 2014, Circulation
Conventional Wisdom about Global Epidemiology of Atrial Fibrillation

Results from “The Lancet Global Burden of Disease study 2010” – A Systematic Review

Percent deaths attributable to atrial fibrillation and flutter by region, 2010

???

Requires EKG

- Lack of resources
- Lack of routine EKG testing
- Out of pocket healthcare costs

Chugh, 2014, Circulation
India: A Perfect Storm for Atrial Fibrillation

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Leading causes of death in India and the number of lives lost

<table>
<thead>
<tr>
<th>RANKING</th>
<th>1990 Death (in lakh)</th>
<th>2013 Death (in lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Ischemic heart disease</td>
<td>15.87</td>
</tr>
<tr>
<td>5</td>
<td>Chronic obstructive pulmonary disease</td>
<td>7.58</td>
</tr>
<tr>
<td>7</td>
<td>Stroke</td>
<td>7.14</td>
</tr>
<tr>
<td>1</td>
<td>Tuberculosis</td>
<td>5.46</td>
</tr>
<tr>
<td>4</td>
<td>Diarrheal diseases</td>
<td>4.13</td>
</tr>
<tr>
<td>2</td>
<td>Pneumonia</td>
<td>4.04</td>
</tr>
<tr>
<td>6</td>
<td>Suicide</td>
<td>2.65</td>
</tr>
<tr>
<td>8</td>
<td>Road injuries</td>
<td>2.64</td>
</tr>
<tr>
<td>NA 9</td>
<td>Hypertensive heart disease</td>
<td>2.62</td>
</tr>
<tr>
<td>NA 10</td>
<td>Diabetes</td>
<td>2.38</td>
</tr>
</tbody>
</table>
India: A Perfect Storm for Atrial Fibrillation

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Disability Adjusted Life Years for Rheumatic Heart Disease (WHO 2004)
Burden of Stroke in India

3 Indians suffer a stroke every minute, don’t know it

Size of each country is proportional to number of deaths due to stroke
“The paucity of data was particularly striking for India: only one relatively small-scale study qualified for inclusion in this review.”
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- 1995 study in a tribal Himalayan village
- Found 0.1% prevalence
  - Single-point screening
  - 94% of participants < 65 years old
The Known Unknown: Atrial Fibrillation Epidemiology in India

“The paucity of data was particularly striking for India: only one relatively small-scale study qualified for inclusion in this review.”

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Barriers:
- Out of pocket healthcare costs
- Lack of routine EKG tests
Overcoming Barriers with Mobile Technology

Letters to the Editor

iPhone ECG application for community screening to detect silent atrial fibrillation: A novel technology to prevent stroke

Jerrett K. Lau \textsuperscript{a}, Nicole Lowres \textsuperscript{a,b}, Lis Neubeck \textsuperscript{b,c,d}, David B. Brieger \textsuperscript{a,e}, Raymond W. Sy \textsuperscript{a}, Connor D. Galloway \textsuperscript{a}, David E. Albert \textsuperscript{a}, Saul B. Freedman \textsuperscript{a,b,e}

Peace of mind in your pocket

FDA-Cleared
Kardia is the most clinically-validated mobile EKG available.\textsuperscript{1}

EKG in 30-Seconds
Smaller than a credit card, Kardia allows you to capture a medical-grade EKG in just 30-seconds from anywhere, anytime.

Track and Share
Kardia’s app-based service enables you to proactively care for the health of your heart. Now you can capture reliable heart activity data and relay it to your doctor to inform your diagnosis and treatment plan.
Overcoming Barriers with Mobile Technology

iPhone ECG application for community screening to detect silent atrial fibrillation: A novel technology to prevent stroke

Jerrett K. Lau, Nicole Lowres, Lisa Neubeck, David E. Albert, Saul B. Freedman, Connor D. Galloway, David B. Brieger, Raymond W. Sy, Atrial Fibrillation in Rural India

<table>
<thead>
<tr>
<th>Device</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tr>
<td>PULSE-SMART</td>
<td>104</td>
<td>.97</td>
<td>.94</td>
</tr>
<tr>
<td>ALIVECOR</td>
<td>204</td>
<td>.98</td>
<td>.97</td>
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SMART-India Feasibility Study
Smartphone Monitoring for Atrial fibrillation in Real-Time - India

RAHI (pathfinder) - SATHI (partnership): UMMS-CAM collaboration

Randomly recruited 353 participants for the screening study

Soni, NIH-IEEE, 2015 || Soni, Lancet-Global Health (Review)
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Screened participants for five consecutive days using Alivecor and PULSES

- 118 participants did not receive Alivecor screening (device malfunction)

Of the 235 remaining participants
- 85% completed four or more screenings
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12 participants screened positive for atrial fibrillation (based on gold-standard of 1-lead EKG reading by a Cardiologist)
• Prevalence: 5.1% (2.7 – 8.7%)

PULSESMART app was less accurate in this setting in comparison to our US clinical study (AUC = 0.67 vs 0.90)

Soni, NIH-IEEE, 2015 || Soni, Lancet-Global Health (Review)
SMART-India: Ongoing Activities

**Smartphone Monitoring for Atrial fibrillation in Real-Time - India**

Recipient of 2016 Office of Global Health Pilot Project Grant

**AIM 1: Evaluate the epidemiology of atrial fibrillation in Gujarat, India**
- Screen 2,000 people from rural and urban regions three times in 1 week
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• Echocardiogram and clinical biomarker evaluation
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AIM 3: Determine the performance of two mobile technologies for community-based atrial fibrillation screening
• Leverage existing workforce of community health workers
• Modify PULSE-SMART to develop Automated Novel AF Non-invasive Detection (ANAND) App for community-based screening in India*
• Compare performance with gold-standard 12-lead EKG tests

* NIH-R03 and Indian Dept. of Biotechnology Grant in Review
Challenges conventional wisdom that atrial fibrillation is a condition disproportionately affecting individuals in North America, Europe, and other high-income countries.
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SMART-India: Future Steps

- Implementation of community-based atrial fibrillation screening program using mobile technology
SMART-India: Future Steps

- Implementation of community-based atrial fibrillation screening program using mobile technology
- Guidelines for initiation and monitoring of anticoagulation treatment
Parting Thought

“What efforts can we take to ensure that some of these very interesting and practical solutions that we make do not remain inaccessible to the people who need it the most...

Because nothing can be more shameful than to have a solution available in 2016, but only accessible to the people who need it in 2076.”

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