6th Asian Preventive Cardiology & Cardiac Rehabilitation Conference
Cum 10th Certificate Course in Cardiac Rehabilitation
3-6 November 2016 | Hong Kong Convention and Exhibition Centre

Mobile Technology in Promoting Community Based CR

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Disclosures

- Cardiatrics: Co-founder and Chief Medical Officer
- Fruitstreet health: Advisory board, hold minimal shares

14-31% of eligible
OVERLOOKED &
UNDERUTILIZED

Barriers to Entry

Provider factors

Lack of physician referrals

Systemic factors

Lack of availability — Access

Geographical inaccessibility

Patient factors

Dislike of group based classes

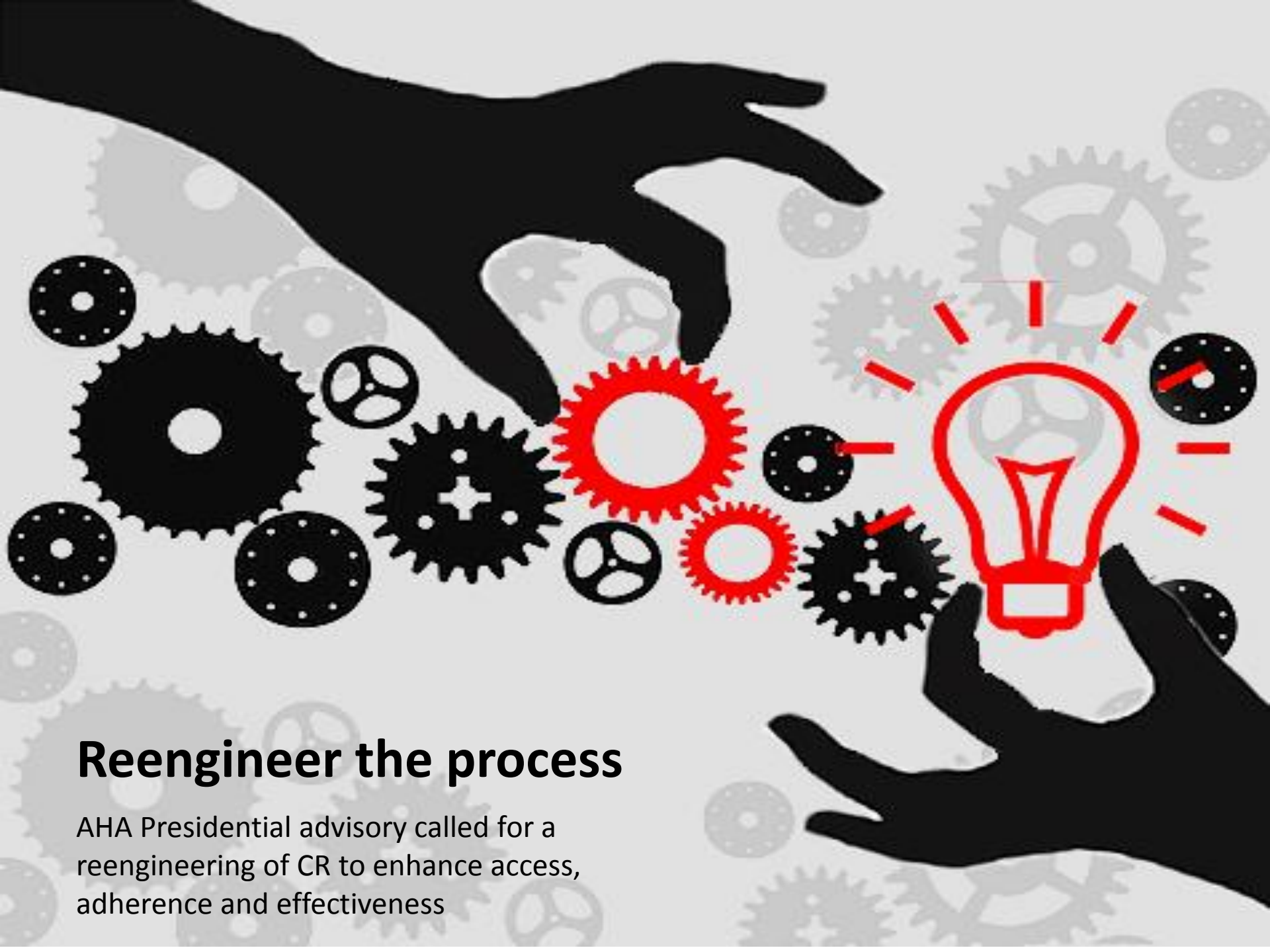
Competing demands — Cost

Lack of motivation

Female gender — Ignorance

Older age

Longer term adherence rates



Reengineer the process

AHA Presidential advisory called for a reengineering of CR to enhance access, adherence and effectiveness

Promise of mHealth

Increase participation
Enhance the experience
Create social networks
Encourage the behavioral change process
Allows risk factor modifications to b
carried out in their regular environment in the community and influence health behaviors real time

DID YOU MAKE SURE TO TAKE TWO PICTURES
SO YOU CAN GIVE ONE TO ME?

- Fact 1: The tsunami of wearable devices is coming!

- Sales of wearable wireless **medical devices** are expected to reach 100mln units or **$2.9bln** in 2016.

Mobile Technology Capabilities

- Receive and interact with information
- Record and review data
- Receive automated feedback
- Connect with other users or healthcare providers

Mobile Phone Apps to Increase Motivation and Physical Activity

- High degree of acceptability and reasonable efficacy for increasing PA and weight loss
- In DM, improvements in blood glucose control demonstrated
- Evidence for mhealth use in CR is limited

Fukuoka Y, Vittinghoff E, Jong SS, Haskell W. Innovation to motivation—pilot study of a mobile phone intervention to increase physical activity among sedentary women. *Prev Med*. 2010;51:287–289.

Stephens J, Allen J. Mobile phone interventions to increase physical activity and reduce weight: a systematic review. *J Cardiovasc Nurs*. 2013;28:320–329.

Pal K, Eastwood SV, Michie S, Farmer AJ, Barnard ML, Peacock R, Wood B, Inniss JD, Murray E. Computer-based diabetes self-management interventions for adults with type 2 diabetes mellitus. *Cochrane Database Syst Rev*. 2013;3: CD008776.

mHealth Studies

Table 2. Completed Studies of Mobile Technology for Cardiac Rehabilitation for Ischemic Heart Disease

Author/Year/ Country	Design/ Duration	Theoretical Foundation	Non-mHealth Components	mHealth Components	Intervention	Control	Outcomes
Worringham[20] 2011 Australia	Observational 6 weeks	None	Telephone contact pre- and postexercise session with provider.	Smartphone, smartphone application, single-lead ECG, GPS with real-time transmission to providers.	Monitored exercise training (walking) 3 times weekly assisted by smartphone application. (N=6)	None	*Usability*: 80% of sessions no technical problems. Ease of use rated 4.8/5 (95% CI 4.6 to 5.0). *Participation*: Completed 80% of scheduled exercise sessions. *Exercise Capacity*: 6MWT improved from 524 to 637 m (P=0.009). *Health Status*: SF36 Physical Health increased from 50.0 to 78.4 (P=0.03), Mental Health unchanged. *Events*: None
Korzeniowska-Kubacka[21] 2011 Poland	Nonrandomized clinical trial 8 weeks	None	Supervised exercise sessions at outpatient clinic. No additional intervention specified as adjunct to home sessions.	Mobile device with preprogrammed exercise training sessions with audio and visual cues for training intensity and 3-lead ECG monitor. Data transmitted via mobile phone.	10 clinic supervised exercise sessions followed by 14 home exercise sessions with mobile application (3 sessions per week). (N=30)	24 clinic supervised exercise sessions (3 sessions per week). (N=32)	*Exercise Capacity*: 17.6±16.1% improvement mobile vs 11.5±35.9% control (P>0.05). *Risk Factors*: BP not significantly changed in either group. *Events*: not reported
Blasco[22] 2012 Spain	RCT 12 months	None	In person assessment. Lifestyle counseling. Intervention participants also supplied with blood pressure cuff, glucose and lipid meter as well as education on use.	Mobile phone with structured questionnaires for entry and transmission of blood pressure, heart rate, weight, glucose, and lipids. SMS messaging of recommendations.	Lifestyle counseling, mobile intervention, devices for home monitoring. (N=102)	Lifestyle counseling (N=101)	*Usability*: mHealth group completed 89% of entries. 5/102 dropped out due to difficulty with mHealth intervention. *Physical Activity*: 75% met goals in mHealth group vs 73% control. *Risk Factors*: mHealth group more likely to improve at least 1 risk factor kor (RR 1.4, 95% CI 1.1 to 1.7) (primary outcome). mHealth group more likely to achieve goals for BP (62.1% vs 42.9%), hemoglobin A1c (86.4% vs 54.2%), and BMI (0.37 kg/m^2 decrease vs 0.38 increase). No significant differences in smoking cessation, cholesterol, medication adherence. *Events*: 5 deaths in control group, 0 in mHealth group

6MWT indicates 6-minute walk test; CI, confidence interval; BMI, body mass index; BP, blood pressure; ECG, electrocardiogram; GPS, global positioning system; RCT, randomized clinical trial; RR, relative risk; SF-36, short form 36; SMS, short message service.

Table 3. Ongoing Studies of Mobile Technology for Cardiac Rehabilitation for Ischemic Heart Disease

Author/ Year/ Country	Design/ Duration	Theoretical Foundation	Non-mHealth Components	mHealth Components	Intervention	Control	Outcomes
Walters[23] 2010 Australia	RCT 6 weeks (intensive) 6 months (follow-up)	None	In-person assessment. Individual goal setting with Mentor. Weekly mentoring sessions. Recommendation for walking-based exercise program.	Smartphone application with step counting, goal setting, diaries (weight, blood pressure, physical activity), visual feedback, text message reminders, educational videos, web portal. Subset will also have ECG and HR monitoring.	Smartphone application plus counseling (N=100). Smartphone application with ECG and HR monitoring plus counseling (N=15)	Outpatient center-based CR (N=100)	*Usability*: survey *Participation*: dropout rates *Physical Activity*: self-reported and objectively measured (primary outcome). *Exercise Capacity*: 6MWT *Risk Factors*: BMI, BP, smoking, alcohol, lipids, HbA1c, med adherence, Diet habits questionnaire *Health Status*: EQ-5D, Health Outcome Questionnaire, SAQ, Psychologic functioning *Cost*: facility, technology, return-to-work *Events*: hospitalizations and death
Maddison[24] 2011 New Zealand	RCT 24 weeks	Self-efficacy Theory	In-person assessment and exercise prescription. Pedometer provided. Web portal for entry of physical activity, viewing videos, educational material.	SMS messages (personalized) for behavioral support to promote self-efficacy.	In-person assessment, personalized SMS messages and web portal. (N=85)	Referral to community-based CR. (N=85)	*Participation*: defined as at least 1 exercise session *Physical Activity*: IPAQ, Phone diary *Exercise Capacity*: Treadmill VO_{2max} (primary outcome), 6MWT. *Risk Factors*: BMI, waist and hip circumference, BP *Health Status*: self-efficacy, SF-36, EQ-5D *Cost*: program and medical *Events*: illness, signs and symptoms
Antypas[25] 2012 Norway	Cluster RCT 1 year	Self-efficacy, Health Action Process Approach, Stages of Change	Completion of 4-week center-based CR program. Internet-based self-management program. Enhanced version includes tailoring of content and messages.	SMS reminder messages to fill out questionnaires.	Enhanced version of internet-based self management program. (N=8 clusters of 15 each)	Internet-based self management program. (N=8 clusters of 15 each)	*Usability*: log-in data, evaluation *Physical Activity*: IPAQ (primary outcome) *Risk Factors*: smoking, alcohol use *Health Status*: self-efficacy, Hospital Anxiety and Depression, social support, EQ-5D *Costs*: return-to-work
Alsaleh[26] 2012 Jordan	RCT 6 months	Social Cognitive Theory, Self-efficacy Theory	In-person assessment and advice for CR. Physical activity diary.	Personalized SMS motivational messages (1/week×3 months then 1/2 weeks×3 months).	Personalized program and SMS messages. (N=71)	Advice from providers on physical activity. (N=85)	*Usability*: evaluation survey *Physical Activity*: IPAQ (primary outcome) *Health Status*: self-efficacy, Mac-New Heart Disease Questionnaire

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The HEART programme was considered likely to be cost-effective for leisure time activity and walking. A mobile phone intervention was not effective at increasing exercise capacity over and above usual care. The intervention was effective and probably cost-effective for increasing physical activity and may have the potential to augment existing cardiac rehabilitation services.

Maddison et al, European Journal of Preventive Cardiology **June 2015** vol. 22 no. 6 **701-709**

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Conclusion: Multi-component behavioural intervention increases physical activity, and improves body composition, physiological and psychological outcomes in CHD patients not attending structured rehabilitation programmes.

BMC Public Health. 2016 Jul 26;16:643. doi: 10.1186/s12889-016-3313-5.

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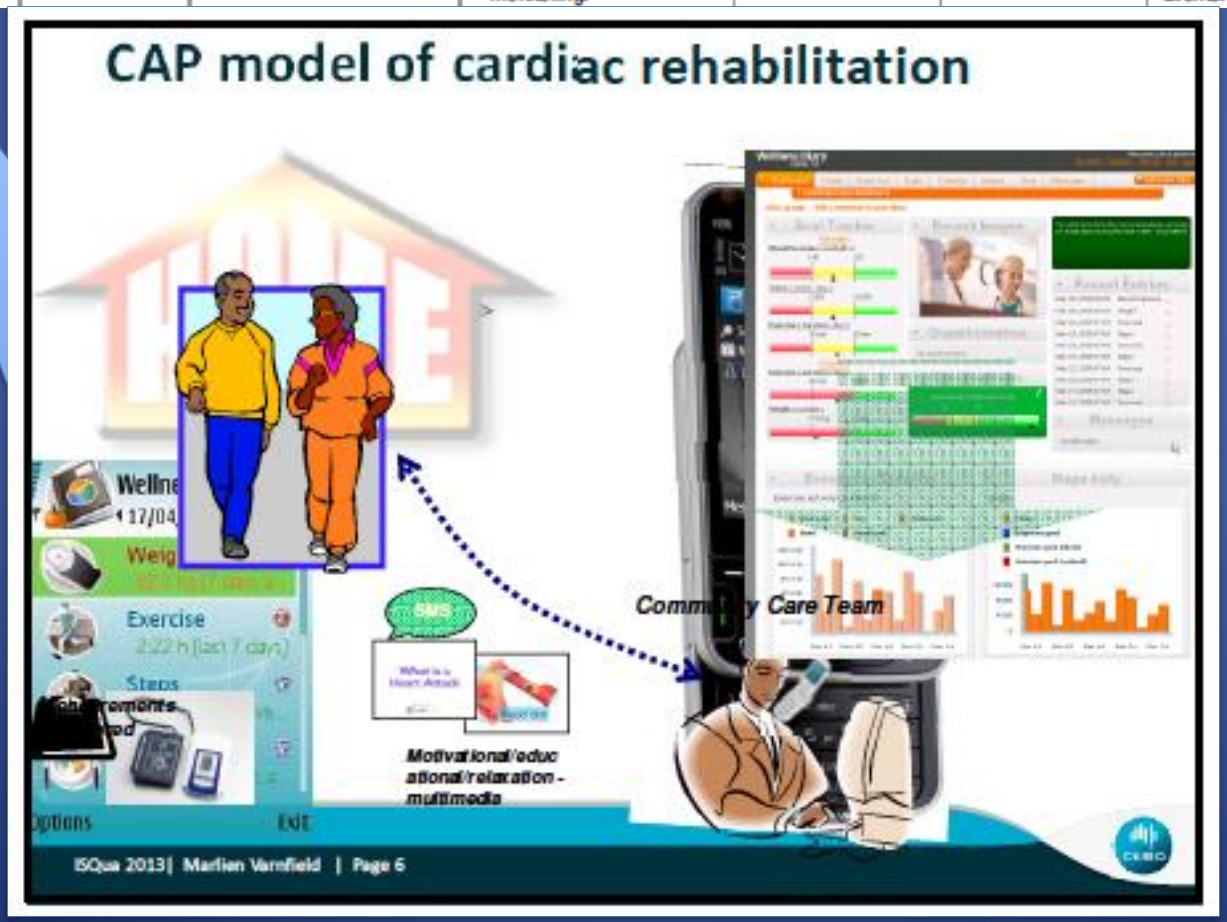
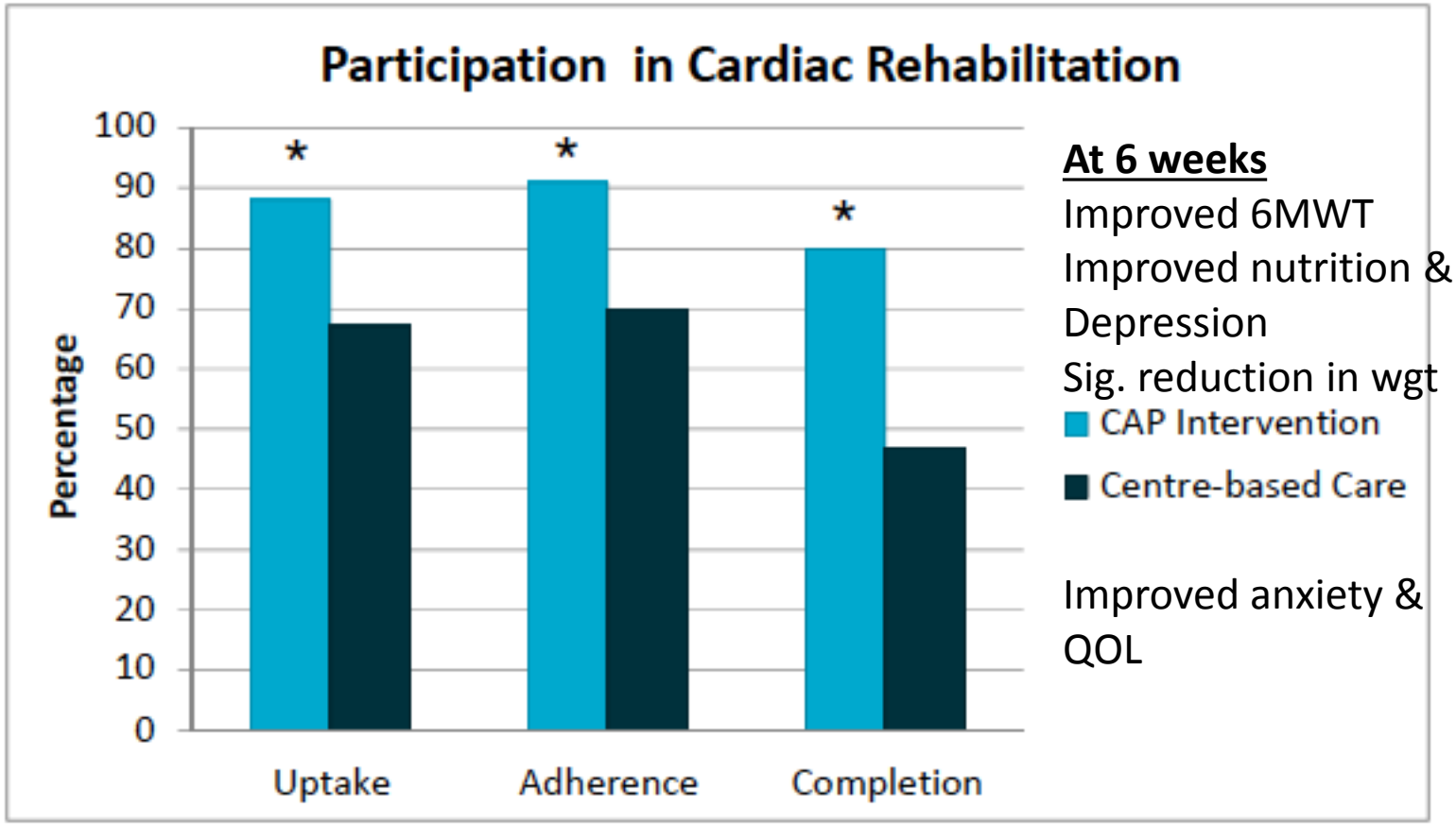


Primary outcomes



At 6 weeks

Improved 6MWT

Improved nutrition & Depression

Sig. reduction in wgt

Improved anxiety & QOL

* $P < 0.05$

What's an Ideal App for CR?

- Should address the core components of CR
- Based on behavior change theory
- RCTs available to compare mobile application delivered program to usual care and assessing important patient centered outcomes
- Optimal combination of core components for mobile delivered CR is unknown
- Tailoring to the individual
- Highly usable

Table 4. Framework for Evaluating Mobile Applications for Cardiac Rehabilitation

1. Address core components of cardiac rehabilitation:
• Patient assessment
• Exercise training
• Self management, may include:
○ Physical activity
○ Diet
○ Medication adherence
○ Smoking
• Psychosocial Support
2. Apply behavior change theory
3. Enable individual tailoring of features
4. Demonstrate high usability
5. Improve patient-centered outcomes:
• Participation in cardiac rehabilitation
• Physical activity (energy expenditure)
• Exercise capacity
• Cardiovascular risk factors (nutrition, weight, blood pressure, cholesterol, diabetes, tobacco use)
• Patient-reported health status (symptoms, functional status, quality of life)
• Cost
• Cardiovascular events
6. Establish efficacy in a randomized clinical trial

Mayo Clinic Study

3 months intervention
25 vs 19 post first AMI and acute PCI
Meant to be a patient self monitoring and tracking tool
App intervention had better diet, were 9lbs lighter, more physically active, lower BP 8mmHg
Control arm 60% readmission or ED visit
within 90 days vs. ~20% for app intervention

Results of the Mayo Clinic study were presented in a press conference Saturday, March 29, at the American College of Cardiology's 63rd Annual Scientific Session in Washington, D.C.

Potential for mHealth in CR

Impact of use of mobile technology is unclear

Mobile devices & wireless services are getting cheaper

Potential further savings on travel costs, fewer lost wages and reduced rates of hospitalization

“Tailor” CR to needs of the individual based on their personal preferences ,clinical needs and environmental and social/cultural situations

Summary

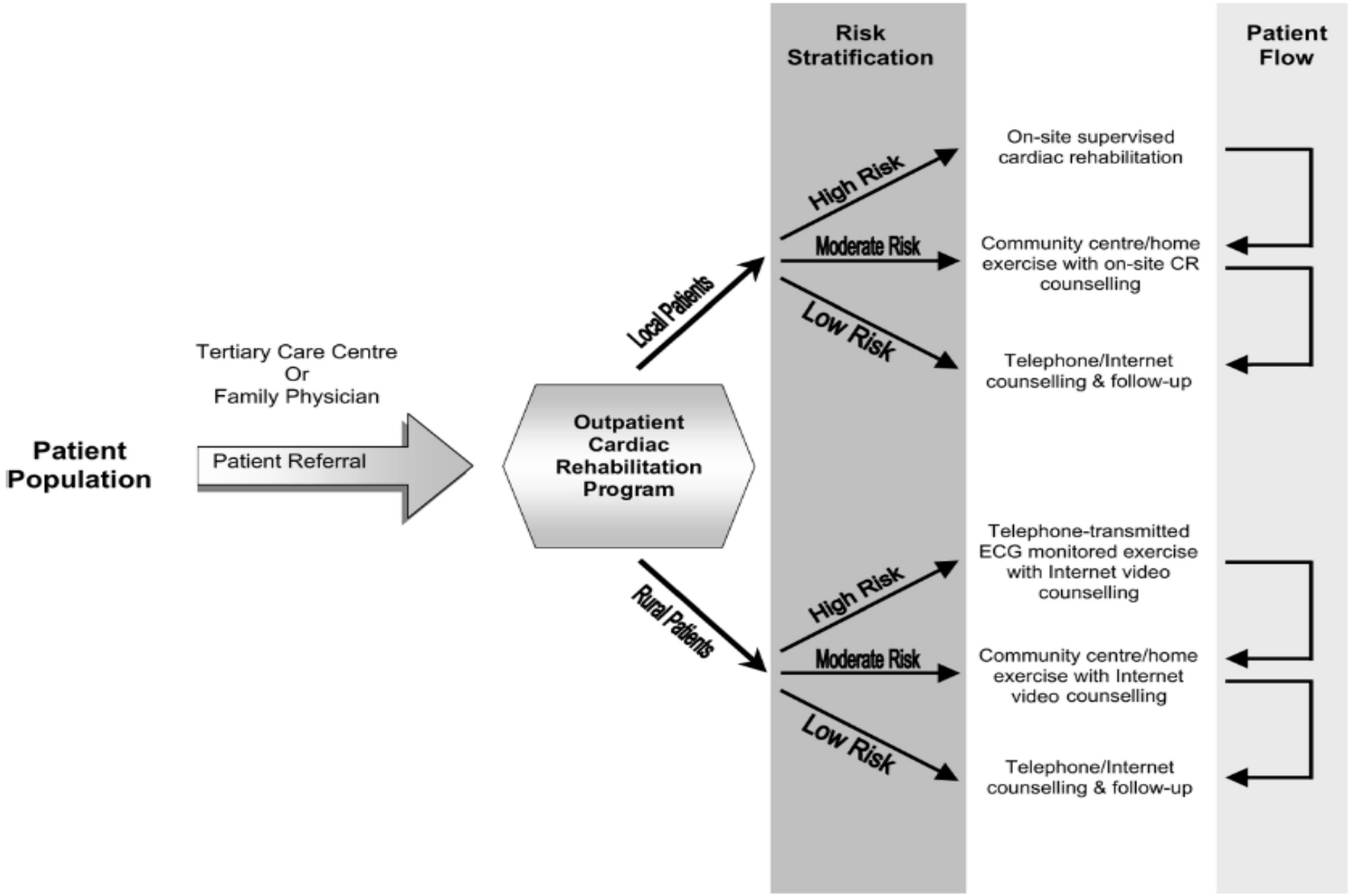
New strategies for promoting participation in CR needed

Initial evidence supports feasibility and acceptability

Potential to improve access, increase participation and improve outcomes in heart patients remains to be seen

mHEALTH

Future CR Model?



Proposed organizational structure for new cardiac rehabilitation (CR) models. ECG, Electrocardiography.

mHealth - Wellframe

CARDIATRICS

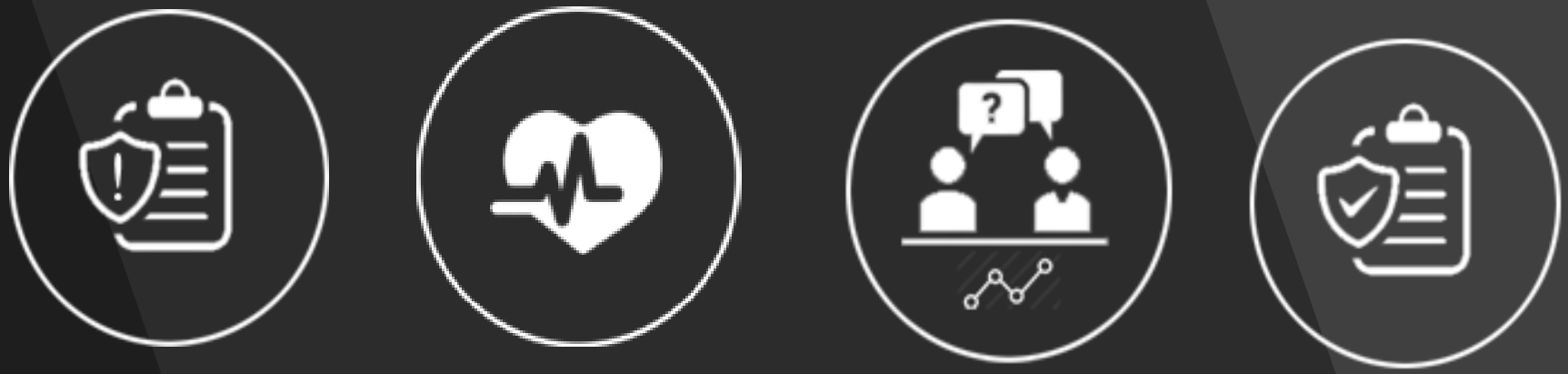
Singapore’s first heart disease prevention program based on risk reduction through behavioral interventions

DOCTORS WHO PRESCRIBE LIFESTYLE CHANGES WITH A CLINICAL IMPACT

We take a scientific approach to changing your lifestyle; so you can see a sustainable reduction in your risk of heart disease. Partner with a designated Doctor and Coach Team who will develop and guide you through personalized solutions including:

- PRESCRIBED NUTRITION
- PROGRAMMED EXERCISE
- STRESS MANAGEMENT
- SLEEP MANAGEMENT
- SMOKING CESSATION ADVICE*

*Additional consultations with a smoking cessation specialist outside of the regular program may be required.



4-MONTH PERSONALIZED PATHWAY

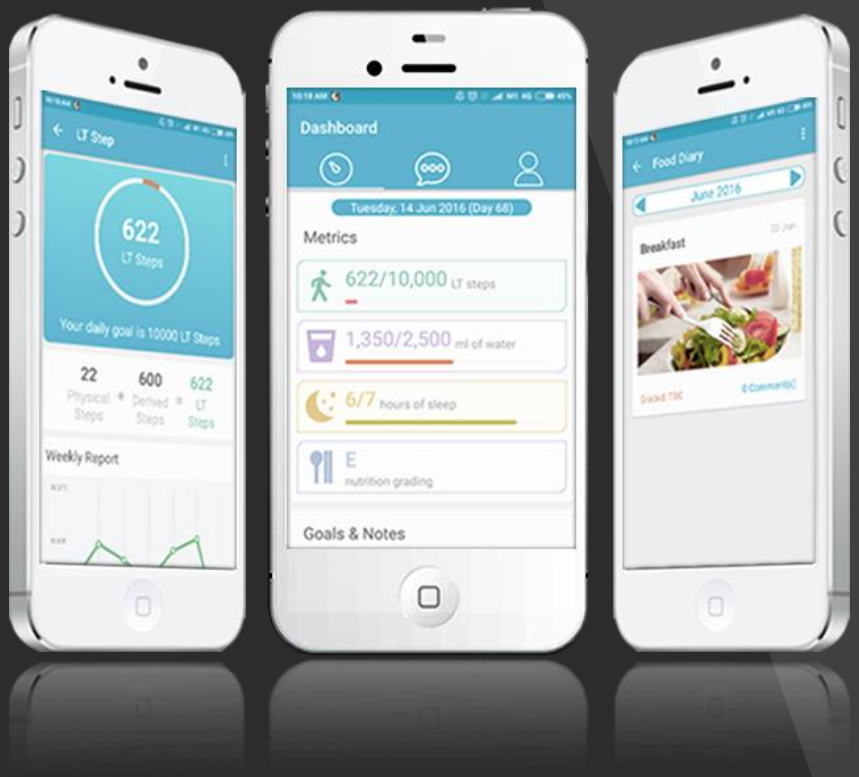
CARDIATRICS

CONFIDENTIAL

TECH-ENABLED SOLUTION

The program is made truly immersive through our proprietary tech-based solution, allowing individuals to always be able to:

1. Track progress/monitoring
2. Keep motivated
3. Stay connected to your Cardiatrics Team



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The End

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