NMRC Awards Ceremony and Research Symposium 2018
April 17th 2018

Delivering impact from digital health technologies

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Aspiring docs told to go for family medicine

Mr Sundheep Subramani (left) from NTU's Lee Kong Chian School of Medicine, seen here with students Ng Guan Yee (centre) from Duke-NUS Medical School and Ong Seeu Kun from National University of Singapore's Yong Loo Lin School of Medicine, says all would-be doctors will most likely have to become generalists. ST PHOTO: DESMOND WEE

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S'pore needs more doctors with general skills, capabilities, says Health Ministry director

Seow Bei Yi

The role of the family physician is set to become more important, said the Health Ministry's director of medical services, Associate Professor Benjamin Ong.

In urging medical students to consider family medicine as a career, he said a smaller percentage of each cohort will become specialists.

Speciality practice, he said, will be less relevant as "many more doctors will need b and depth, and general professional skills and capabilities".

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Ministry of Health › Press Room › Press Releases › 2017 › One Singaporean, One Family Doc

News Highlights

One Singaporean, One Family Doctor

1. Primary care is the foundation of our healthcare system, and family doctors are at the frontlines of healthcare in the community. Declared by the World Organization of Family Doctors, World Family Doctor Day celebrates the role and contribution of family doctors in healthcare systems world on 19 May every year. On World Family Health (MOH) would like

Print

Introductions...

By 2030 more people will die in the developing world from heart attacks and strokes than from infectious diseases

World Health Organization, December 2016

Chronic illnesses “cause billions of dollars of losses of national income and they push millions of people below the poverty line, each and every year”

WHO Director-General Dr Margaret Chan at the launch of the organization’s Global Status Report on Non-Communicable Diseases, December 2016.

Primary health care is not flashy, but it works...

...monitoring the general health of communities, treating chronic conditions and providing day-to-day relief.

The Economist - Aug 24th 2017

Equipping primary care for chronic disease care

- Train those already providing care
- Design better incentives
- **Make better use of technology**

The Economist - Aug 24th 2017

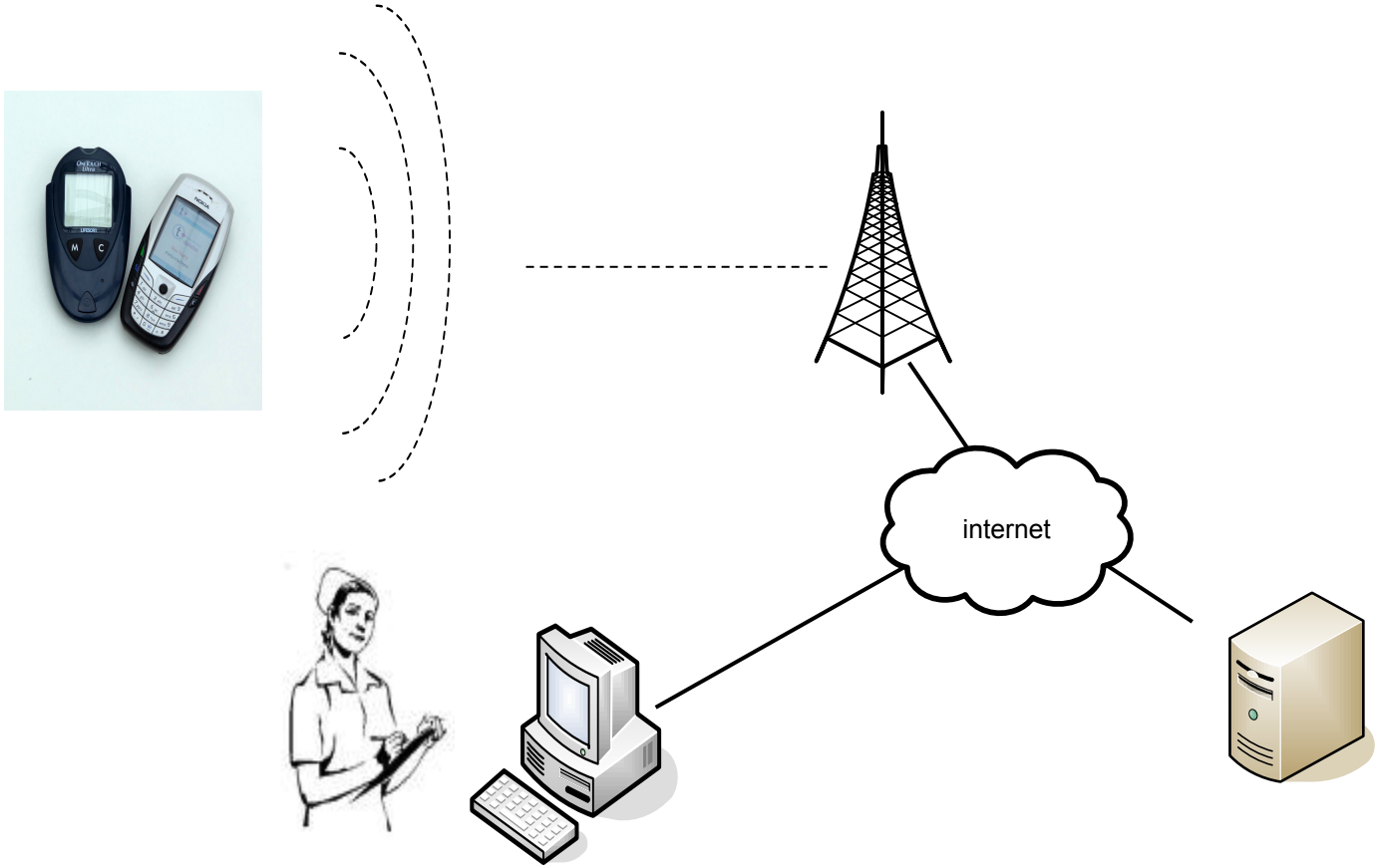
Identify uncertainties

Research

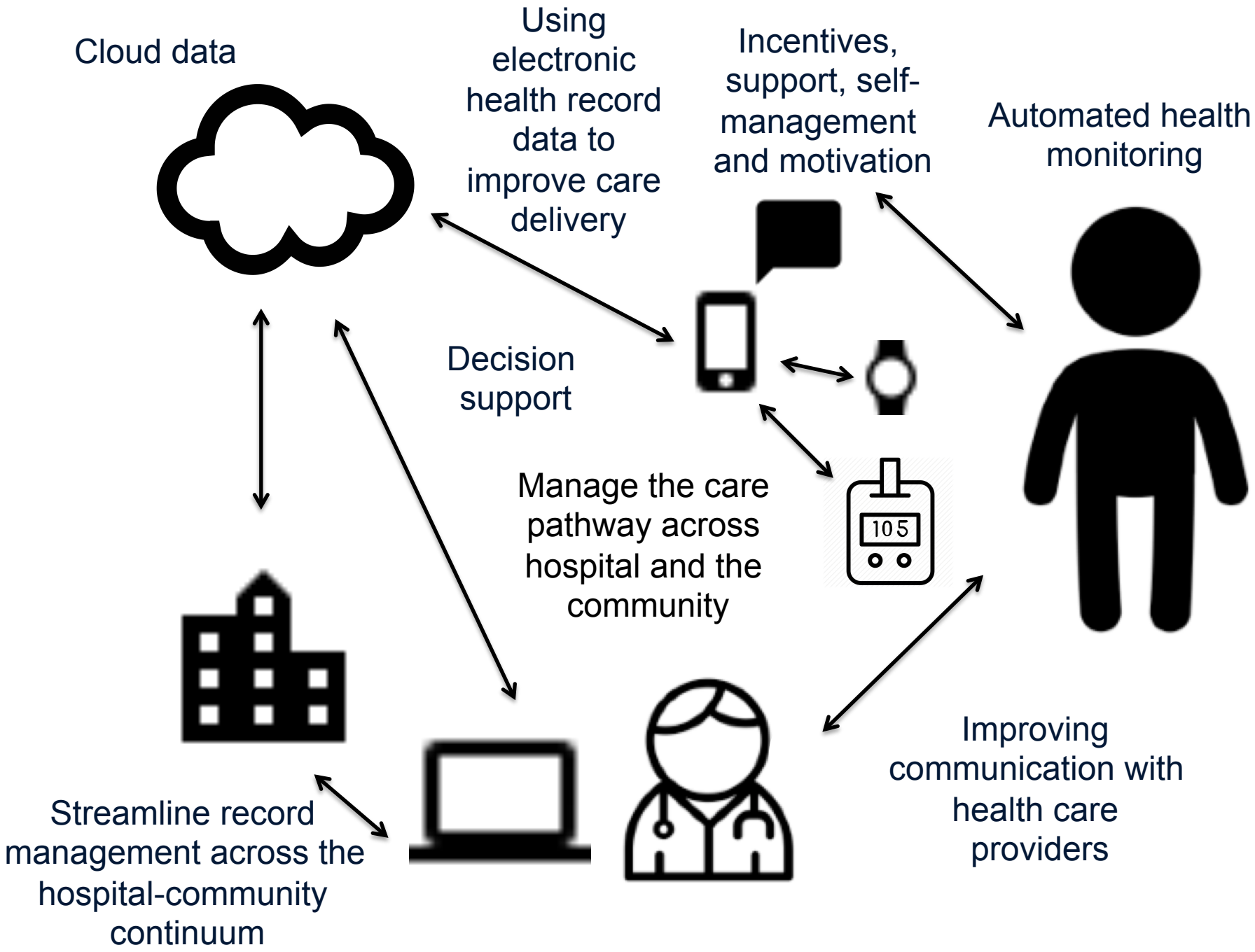
Inform policy, practice and further research

... research focussing on exploring gaps in delivery of care to people with long-term and chronic conditions, developing low-cost technological solutions and testing their impact on health outcomes...

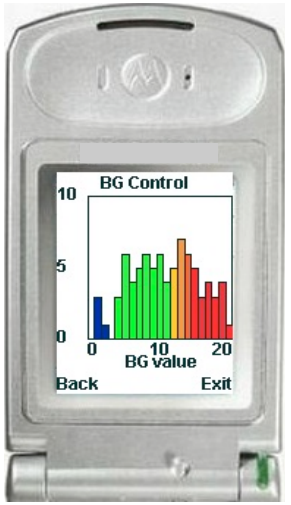
The Oxford telemedicine system for diabetes self-management

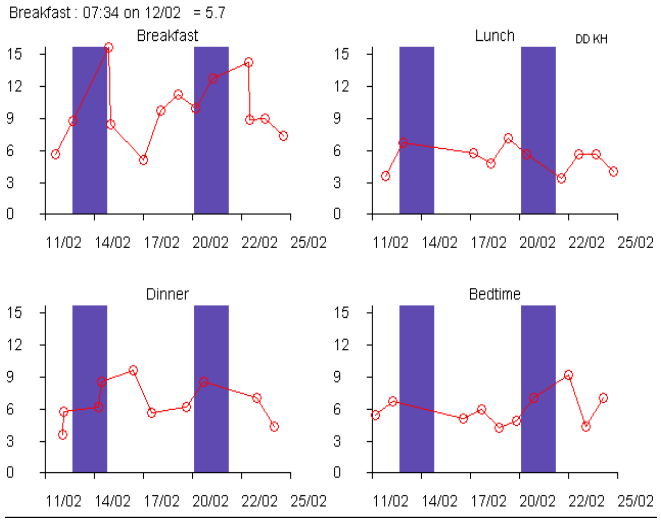


Farmer et al. *Diabetes Care* 2005; **28**:2697-702


Cloud data
Using electronic health record data to improve care delivery
Incentives, support, self-management and motivation
Automated health monitoring
Decision support
Manage the care pathway across hospital and the community
105
Streamline record management across the hospital-community continuum
Improving communication with health care providers

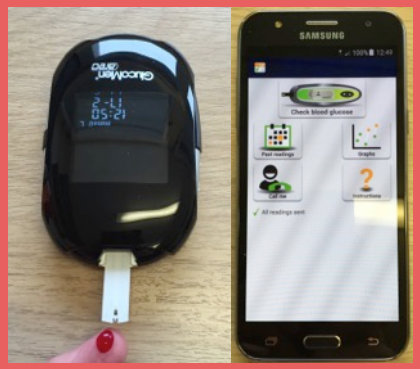
A telemedicine system for diabetes





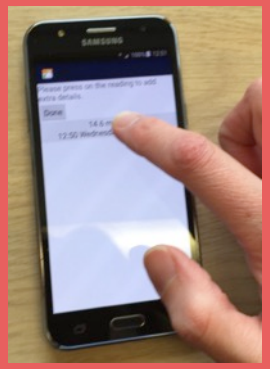
Farmer et al. *Diabetes Care* 2005; **28**:2697-702

1. Measure BG



2. NFC transfer to App

3. Label and send

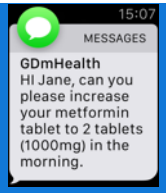


Secure Data capture and storage

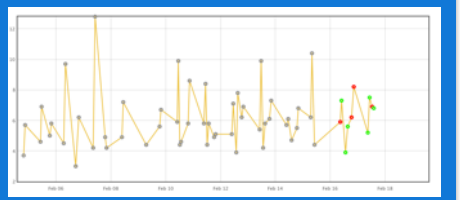
NHS

Day	Breakfast		Lunch		Evening meal	
	Before	After	Before	After	Before	After
Thu 18 Feb 2016						
Wed 17 Feb 2016	5.2 (08:56) 2 mg Met	7.5 (10:30) 2 mg Met	6.9 (12:42)	6.8 (14:10)		
Tue 16 Feb 2016	5.9 (08:50) 2 mg Met	7.3 (09:55) 2 mg Met	3.9 (13:23)	5.6 (15:20)	6.2 (18:40) 1 mg Met	8.2 (20:39) 1 mg Met
Mon 15 Feb 2016						

Annotated results in tabular and graphical displays

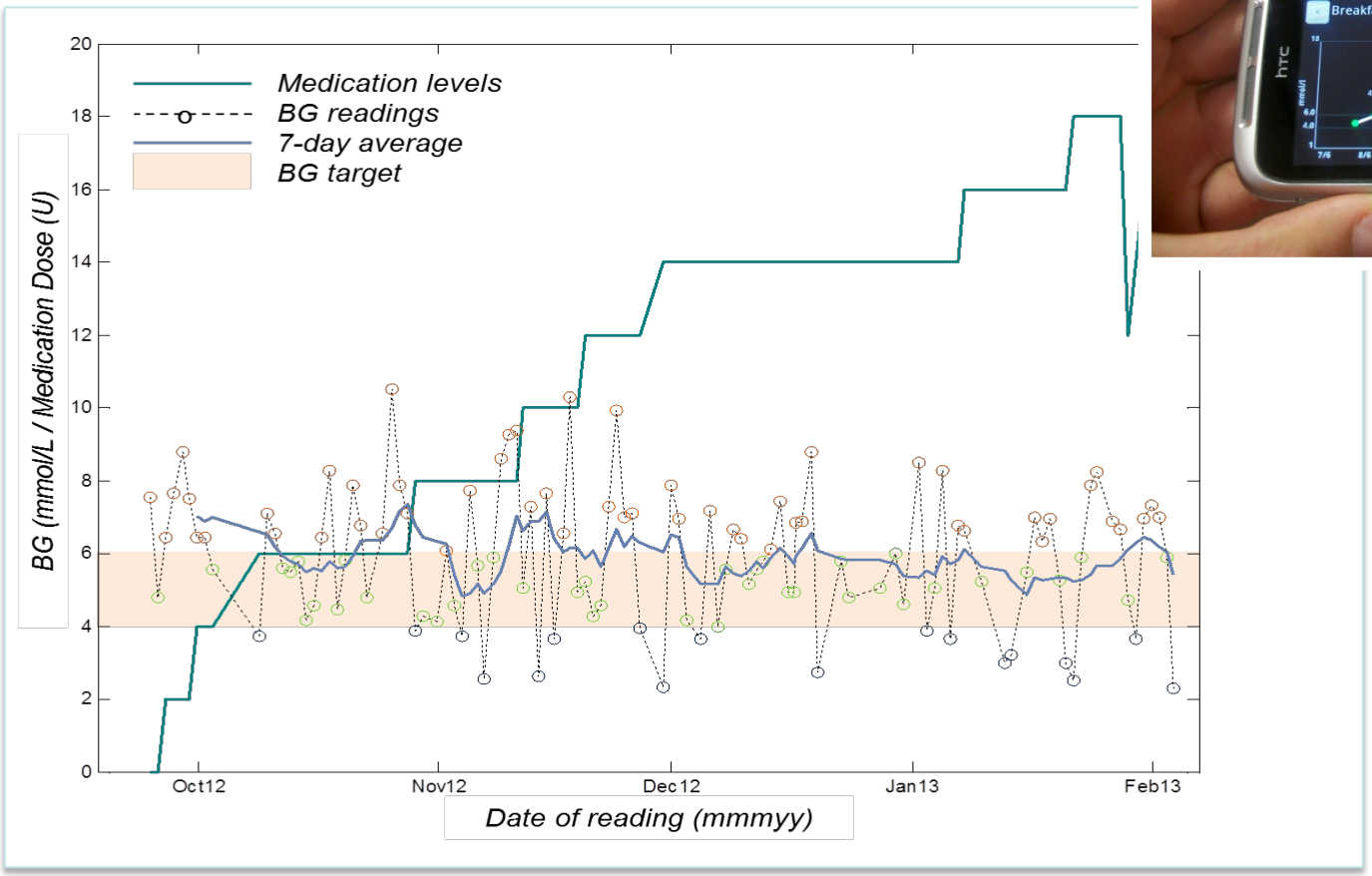


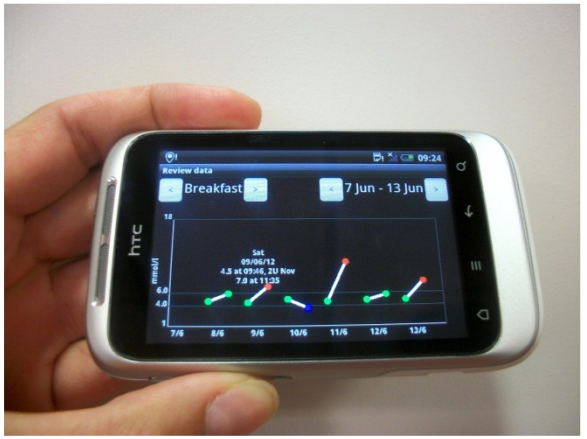
SMS to woman via website



MacKillop, L. *et al*. *JMIR mHealth and uHealth* **6,** e71 (2018).

Gestational Diabetes – Monitoring blood glucose





MacKillop, L. *et al*. *JMIR mHealth and uHealth* **6,** e71 (2018).

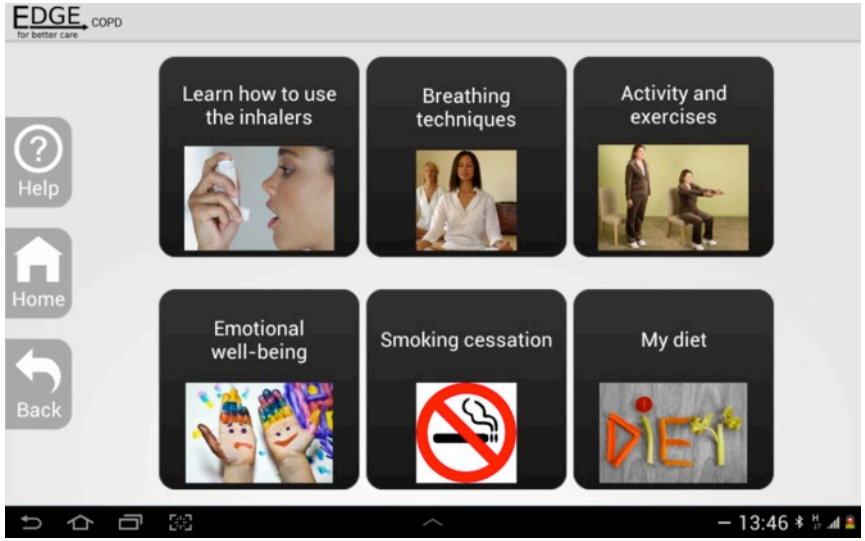
wellcome trust

DH Department of Health

EDGE
for better care

Changes to the EDGE system made as part of lay (user) feedback

- Change to interface (background/ icons)
- Clarification on symptom questions
- Flow of symptom questions
- Frequency of mood screening



Design of the EDGE trial

- Individually randomised controlled trial
- An allocation ratio of 2:1 between intervention and standardised usual care
- Inclusion criteria
  - Age >40 years
  - Predicted ratio of FEV1 to FVC <0.70
  - Smoking history >10 pack years
  - MRC dyspnoea scale >2
  - Admission for COPD or referred for pulmonary rehabilitation

Farmer A et al. *J Med Internet Res*. **19,** e144–15 (2017).

Feasibility and usability

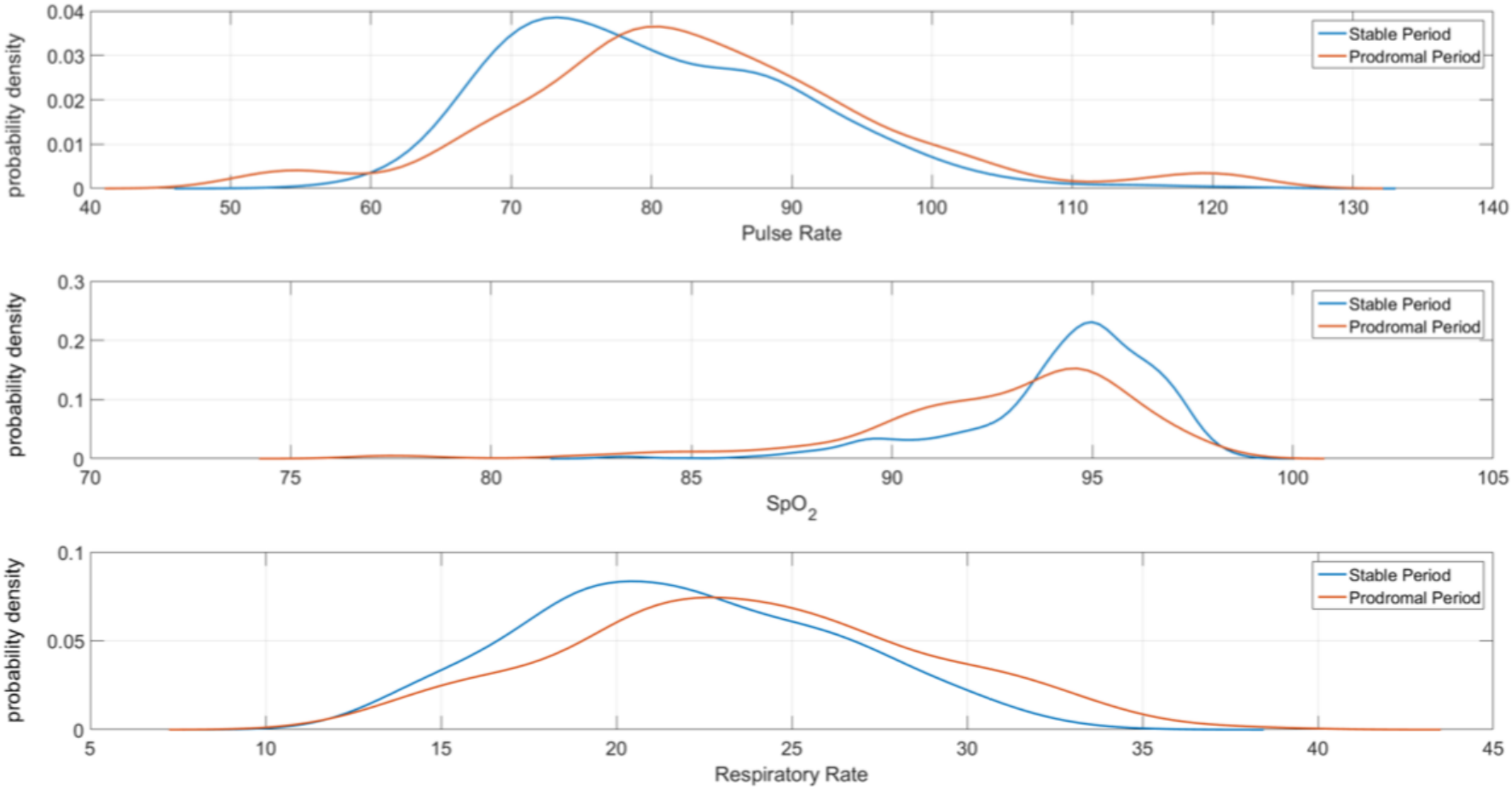
- Of the 110 given the EDGE system 100 (91%) used it for at least six months.
- On average, people used the system for six days each week.
- Only two people used the system for less than three days a week.

Farmer A et al. *J Med Internet Res*. **19,** e144–15 (2017).

Table 3. Secondary outcomes baseline to 12 months.

Secondary outcomes	Overall effect comparing EDGE and usual care			
Change in EQ-5D-5L, mean (SD)	0.01 (0.2)	−0.08 (0.2)	0.076 (0.009-0.14)	0.03
Number of GP contacts (surgery), median (IQR)	0.78 (10.2)	5.5 (2-10)	-	0.06
Number of nurse contacts (surgery), median (IQR)	4 (2-7)	2.5 (1-7)	-	0.03

Predicting changes in health



Vital signs data for a patient with COPD when stable and when deteriorating

Shah, S. A. et al. *J Med Internet Res* **19,** e69 (2017).

Mobile phone text-messaging for people with chronic disease in sub-Saharan Africa

Objectives

To assess the effect of SMS text-messaging across sites in sub-Saharan Africa

People

Hypertension and type 2 diabetes

Design

Randomised trial with process evaluation

sana

OpenMRS
MEDICAL RECORD SYSTEM

MRC | National Institute for Medical Research

wellcome trust

GACD
GLOBAL ALLIANCE FOR CHRONIC DISEASES
AN ALLIANCE OF HEALTH RESEARCH FUNDERS

Why does it matter if people don’t take their treatment as recommended?

- Medicines not taken do not improve health
- Not taking dispensed medicines wastes money
- Ignoring non-adherence leads to unnecessary dose increases or changes in medicine in an attempt to improve response.
- Drug resistance (antibiotics)

Scope and impact of non-adherence

- Up to 37% of diabetes patients have stopped their blood glucose lowering medicine within one year of starting treatment.
- For those continuing with treatment, about 70-80% of doses are taken as prescribed.
- Adherence falls further as the number of tablets increase.

Objectives and design of the StAR trial

Objectives

- To assess the effect of an automated treatment adherence support programme delivered by mobile-phone based short messaging system (SMS) text messaging for people with high blood pressure on levels of blood pressure at 12 months.

Evaluation design

- Single-blind, individually randomised, three-arm, parallel group trial.

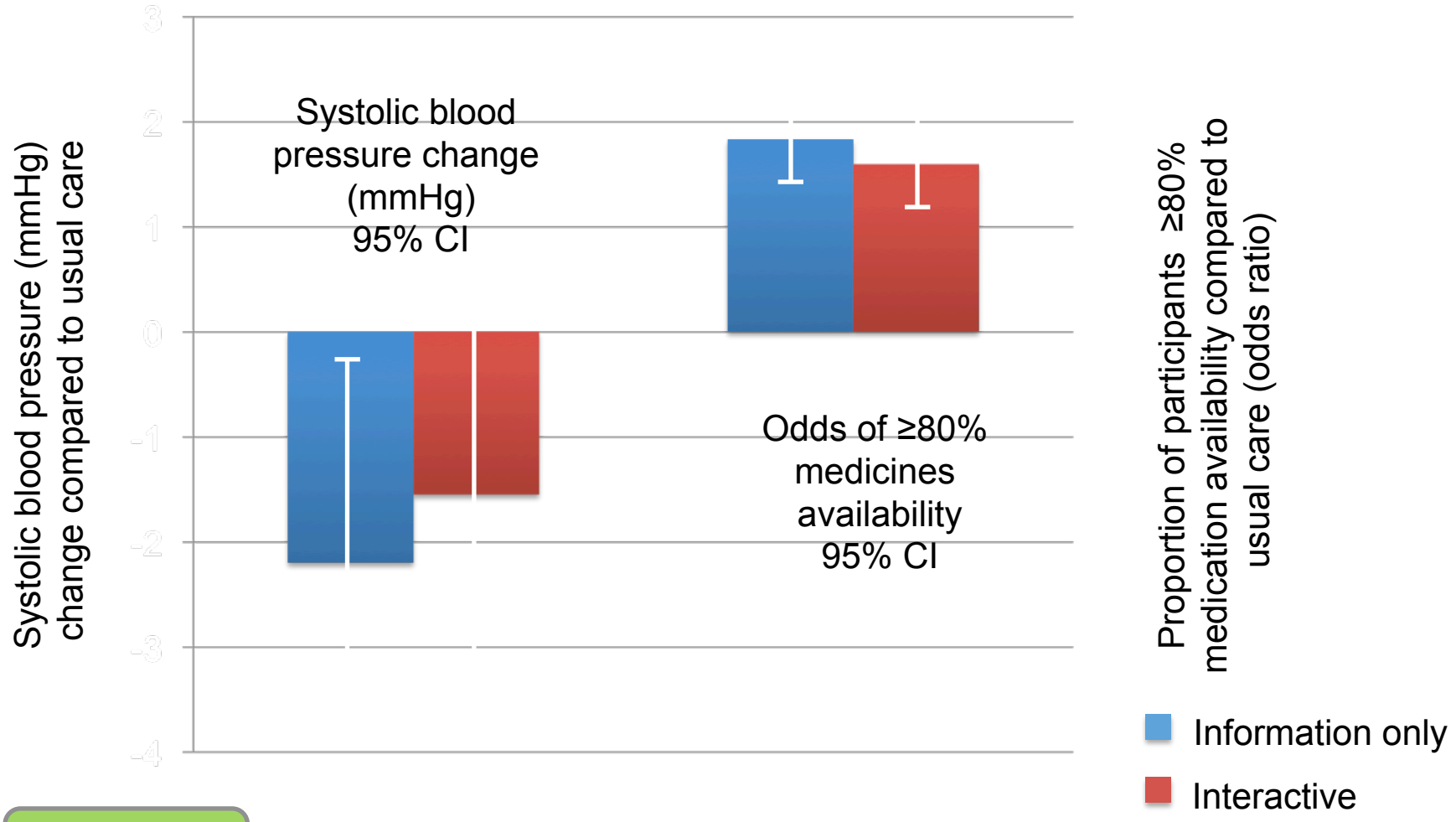
Outcomes

- Systolic blood pressure measured using a standard protocol with a validated automated oscillometric sphygmomanometer.
- Availability of blood pressure lowering medication calculated from dispensing and clinic record data

* StAR

Bobrow, Farmer et al (2016) Circulation 133: 592-600.

Summary of findings by intervention groups compared to usual care over one year

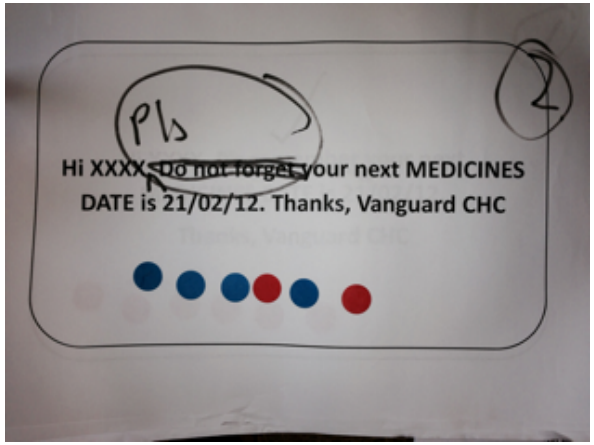


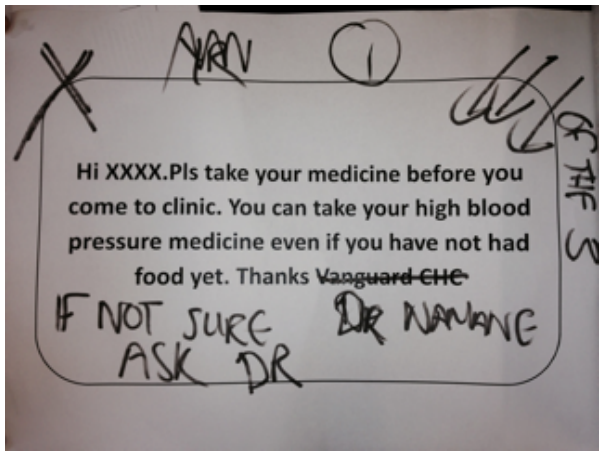
* StAR

Bobrow, Farmer et al (2016) Circulation 133: 592-600.

Working with patients to optimise the effectiveness of interventions delivered via SMS

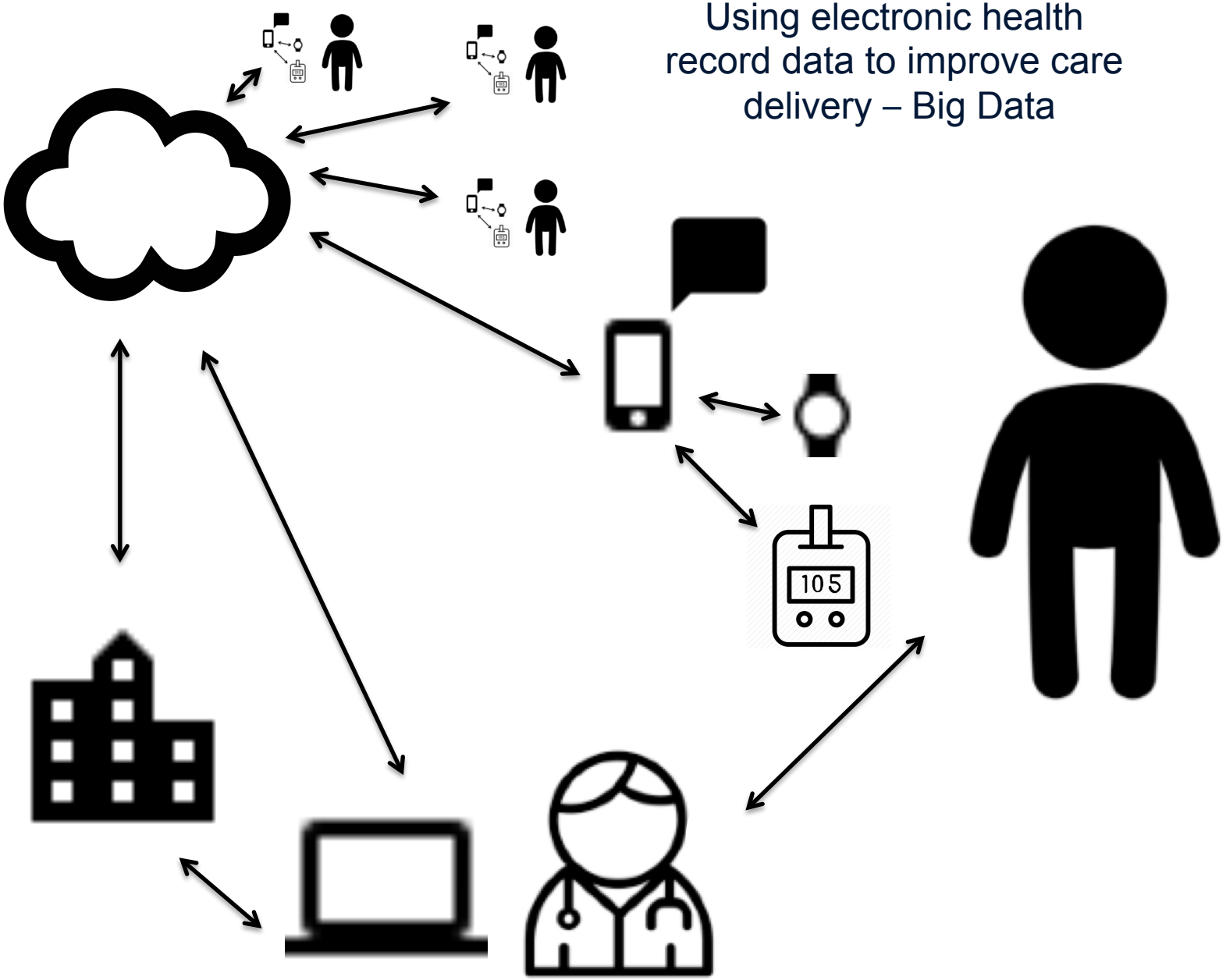
Behaviour change technique used	Example from SMS-bank
Goals & planning	A pill box can help you to remember when to take you high blood pills.We encourage you to get one.For more info ask PHARMACY. Make taking your pills part of your daily routine, like when you brush your teeth.Doing this can help you remember to take them regularly.
Repetition & substitution	Pls remember your next CLUB DATE is on [DAY][DD/MM/YY] at [TIME].
	Thnx for picking up your meds. Keeping on your pills & attending on your correct dates helps us serve you better.
	We missed you @ CLUB.We hope you're OK.Pls be sure to come in to collect your MEDICINE.
Social support	Ask someone you trust to help you remember to take your medicine as directed.
	You're doing very well.Pls keep on with your pills,come on your clinic dates,excersise&eat healthy food
Natural consequences	Pls remember your high blood can't be cured.To keep healthy pls keep on with your pills,come on your clinic dates,excersise&eat healthy food





* StAR

Using electronic health record data to improve care delivery – Big Data

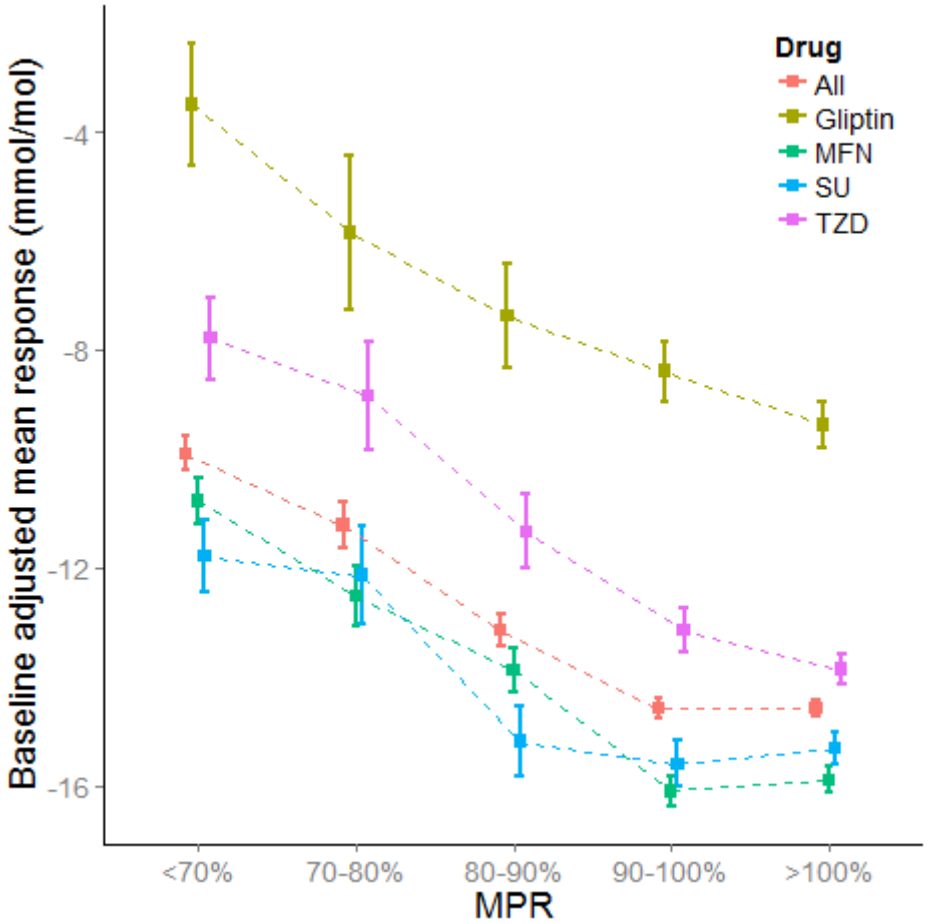


What can we find out from routine prescribing data?

- How much does sub-optimal adherence affect response to glucose lowering treatment?
- Patients with type 2 diabetes >35 years starting treatment with oral glucose lowering treatment
- Clinical Practice Research Datalink
- Data recorded by general practitioners between 2002 to 2013
- Adherence measured by the proportion of prescriptions provided as a proportion of those expected (Medication Possession Ratio)
- 80% of medicines taken as expected was pre-defined as “adhering to treatment”.

Farmer et al. *Diabetes Care* 2016; **39**: 258-263

Change in HbA1c (response) at differing levels of adherence (MPR)



Farmer et al. *Diabetes Care* 2016; **39**: 258-263

Effective medicines use for type 2 diabetes

- SuMMiT-D is a six-year development programme funded by the NIHR Programme Grant Funding Board
- Development of behavioural intervention delivered by mobile devices and SMS messaging
- Trial evaluation with individual patient consent
- Integration with EHR for prescribing records at a national level to enhance effectiveness

Understanding the impact of new technologies...

- Innovation and new technology
- Evaluation and testing
- Patients and society
- Achieving change
- Systems

FUTURE TECHNOLOGIES	Years 0–2	Years 3–5	Years 6–8	Years 8–12	Years 12+
Security	Better use of existing security systems National governance and data sharing agreements	Trusted data curation Development of anonymised datasets	Scalable platforms with high security, validation of access and recording of access	Protection against reverse engineering of patient records	
Sensing	Non-invasive multi-modal sensors	Night time sensing		Contactless vital signs sensors	Implantables
Integrated Technologies		Linking primary care data to hospitals	Decision assistance systems		
Data Analytics	Intelligent and appropriate reporting of health summaries Time series data analytics	Robust data integration - chemical, visual, etc. Data compression, transfer and storage Machine learning algorithms with data reduction at each step Genetic testing and prediction Data fusion of symptom checkers for 111	Tools to extract clinical meaning from data Trusted machine learning platform	Non-wearable monitoring in the home, car, etc.	Multi-input data analytics platform
Devices	Modular sensor platforms for plug&play Voice-controlled systems	Apps to guide patients through the healthcare systems Intelligent wearables for physiological monitoring	VR for -patient education -teleconferencing -change environment -data visualisation		
Open Source Platforms	Internet of Things Chat bots	Machine learning for common conditions Collection and archiving of validated datasets	Integratable and interoperable digital health solutions		

The Technology Roadmap – FAST Digital Workshop (EPSRC 2017)

Health technology assessment refers to the the systematic **evaluation** of properties, effects and impacts of **health technology**. It is a multidisciplinary process to evaluate the social, economic, organizational and ethical issues of a **health** intervention or **health technology**.

WHO Definition (EB 134/30)

Better evidence needed before adoption

When new technology becomes heavily promoted and widely adopted, it can become more difficult to convince providers and consumers that there are better, cheaper, or more appropriate alternatives. … Also, some technology has gained widespread adoption without much evidence that it is cost-effective for all persons with diabetes.[1]

[1.] Simon J, et al. Cost-effectiveness of self-monitoring of blood glucose in patients with non-insulin treated type 2 diabetes: economic evaluation of data from the DiGEM trial. *BMJ* 2008; **336**: 1177–1180.

Kahn R, Anderson JE. *Diabetes Care* 2009; 32 (6):1115-1118.

A checklist for reviewing digital health systems:

…focussing on the problem and outcomes

1. Does the technology work?
2. Is the system safe?
3. Does the system meet government and other standards in the way it is built and handles information
4. Does the system link into other technological systems (e.g. hospital and GP computer systems?
5. Is the clinical problem that the system is intended to address clear and how can the impact be measured?
6. To what extent is there evidence that the system has an important impact on the health problem targeted?
7. How well does the system fit into the health care worker routines? Is it easy to use and does it make the work easier?
8. Patient/public systems: Well advertised, free, attractive, people come back
9. Can the system be scaled within the public health system?
10. Can the system be sustained (health system, financial)?
11. Is privacy and data security considered?
12. Is there a health economic investment case for cost-effectiveness?

With thanks to Peter Benjamin. Cape Town, South Africa 2017

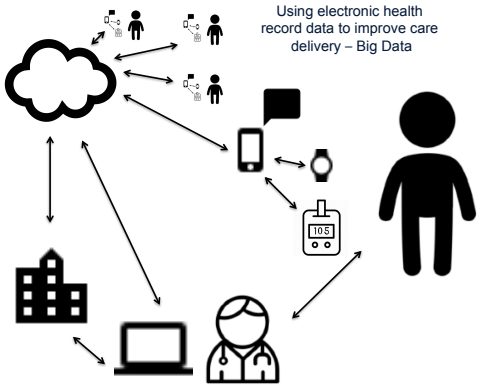
Legal and ethical issues remain to be resolved

- Conventional “Nudge” techniques channel attention in decision making in preferred directions with forbidding options or changing financial incentives
- “Big Data” analytic nudges (Hyper-nudge) are extremely powerful and potent due to their networked, continuously updated, dynamic and pervasive nature
- Concerns about the legitimacy of these techniques are not satisfactorily resolved through reliance on individual notice and consent

Yeung K. *Information, Communication & Society* 2016: 20(1):118-136

Digital health: intervening to support better care

- Improve communication with patients
- Streamline patient record management
- Automate health monitoring
- Enhance people's experience of healthcare
- Incentives, support, self-management, motivation
- Manage the care pathway across hospital and the community
- **...A step-change in research capability**



Acknowledgements