

accuRx.

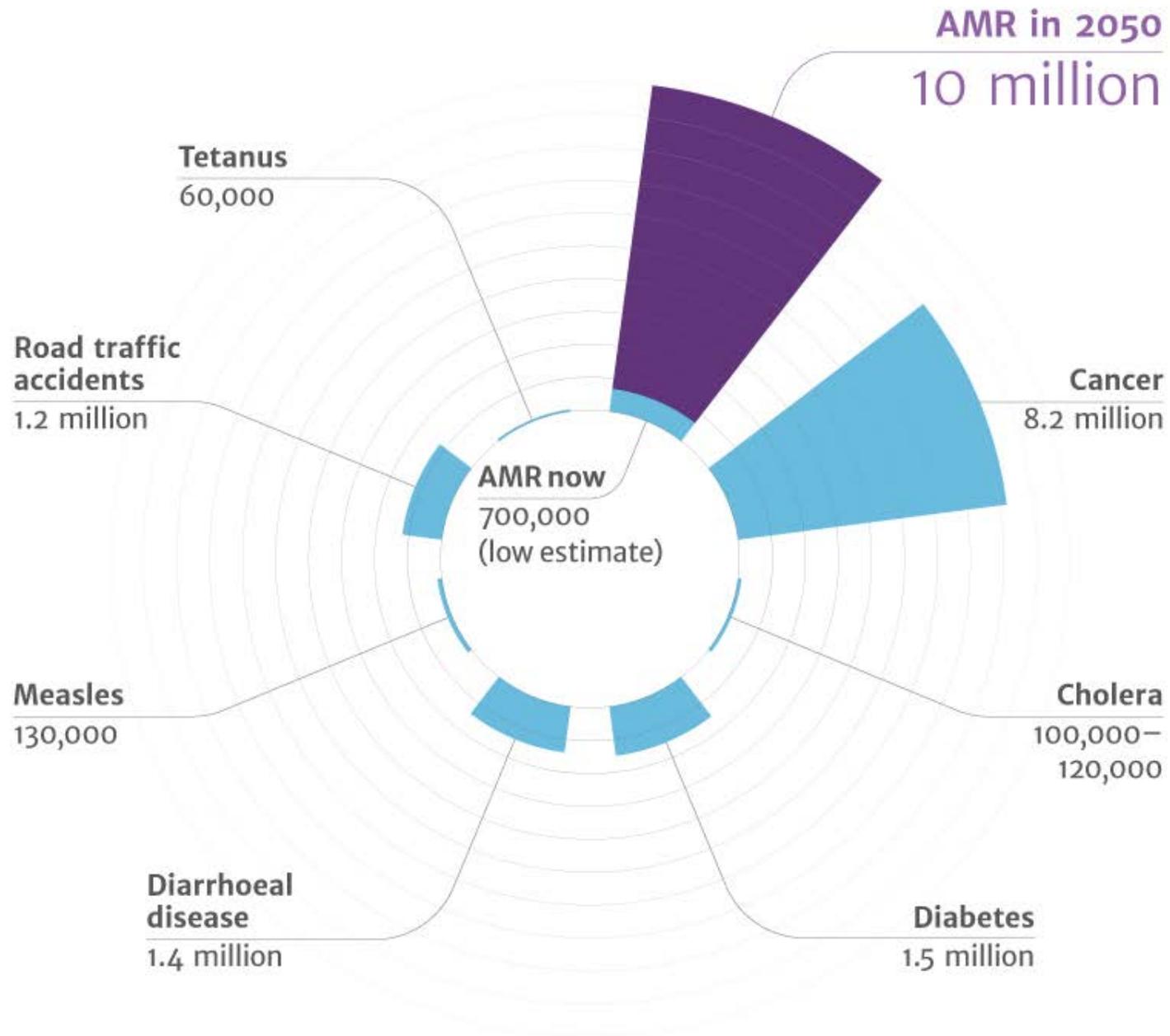
Eliminating inappropriate antibiotic use

Building a data-driven rapid diagnostic

Department of Primary Care, University of Oxford

23/02/2016

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Antimicrobials are rapidly becoming less effective.

To tackle AMR, we need to...

Reduce demand for antimicrobials

Inappropriate use of antibiotics is high – up to 67%

Prescribing as in 1950s

Needs to be done safely

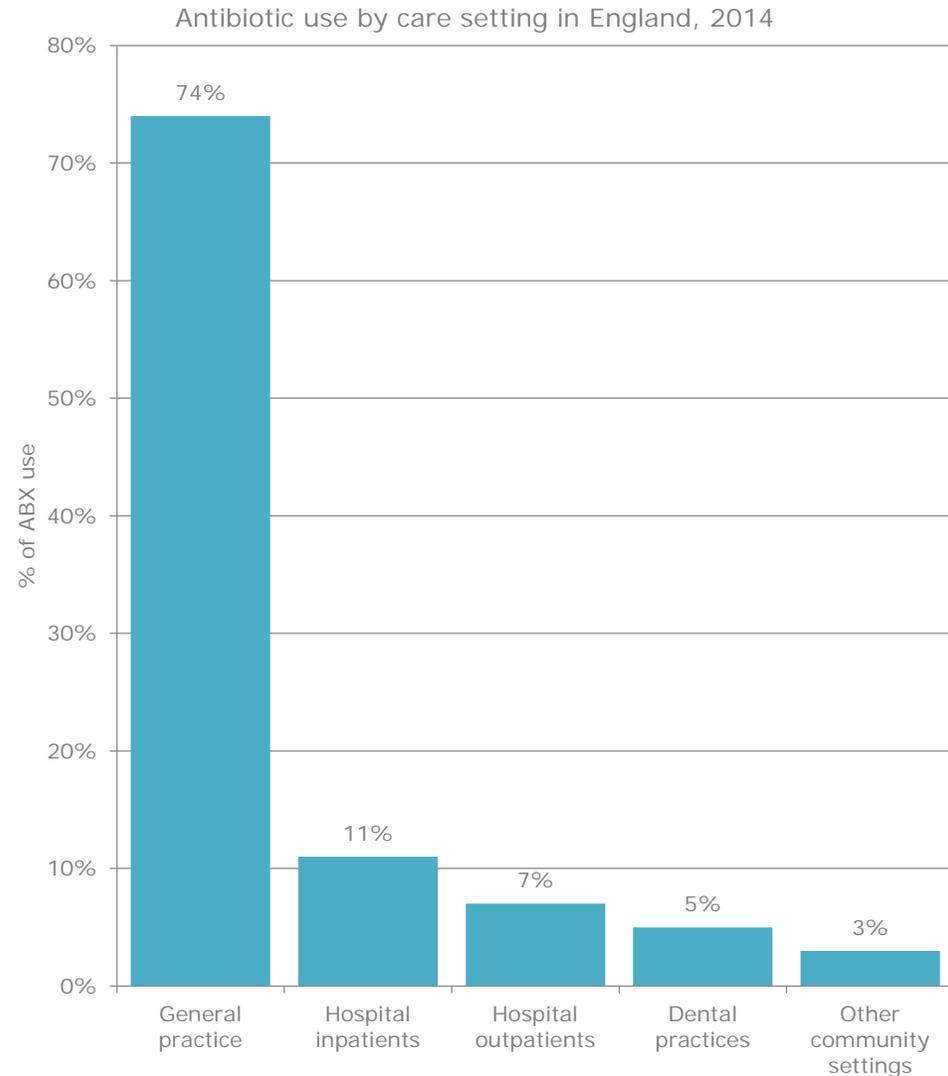
Increase supply of new antimicrobials

No new class for 30 years

Broken market

Resistance will always occur

Where do we start?



Source: ESPAUR Report 2015, Public Health England



Better IT adoption

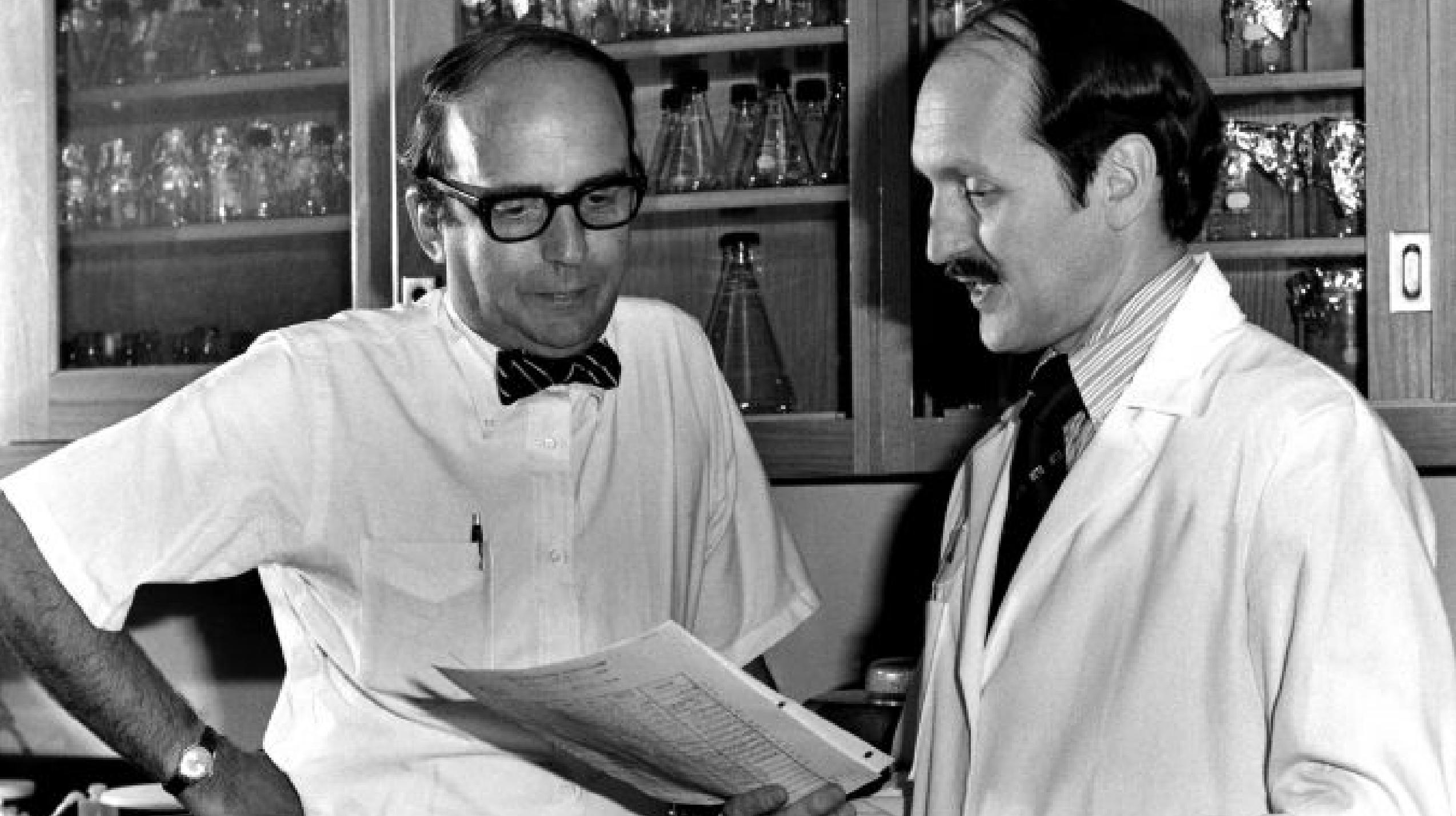


Lower acuity patients



No onsite labs/clinical microbiologists





Widespread call for rapid diagnostics

the
PHARMACEUTICAL JOURNAL
A Royal Pharmaceutical Society publication

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Antimicrobial resistance

Government review says antibiotics should not be prescribed without rapid diagnostic test

The Pharmaceutical Journal | 20 MAY 2016 | By Ingrid Torjesen

Report says developed countries should lead the way and build rapid testing to tackle antimicrobial resistance

LONGITUDE PRIZE

THE RACE IS ON

Longitude Prize is a challenge with a £10 million prize fund to reward a diagnostic test that helps solve the problem of global antibiotic resistance. It is being run by Nesta and supported by Innovate UK as funding partner.

NIH National Institutes of Health
Turning Discovery into Health

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NEWS RELEASES

Thursday, April 9, 2015

NIH funds nine antimicrobial resistance diagnostics projects

distribute.

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Rapid tests 'would cut antibiotic use'

Rapid diagnostic tests are urgently needed to help doctors know which patients need antibiotics, a report says.



The Telegraph

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Two thirds of antibiotics are needlessly prescribed, a report warns

Economist Jim O'Neill has published a report which calls for more diagnostic procedures to help GPs avoid unnecessary prescriptions

Two thirds of antibiotics are needlessly prescribed, warns a report which says new diagnostics tests are urgently needed to curb their over-use.



the guardian

website of the year

Rapid diagnostic tools needed to fix antibiotic crisis, says review

Government paper says fundamental change is 'essential' to stop antibiotics being prescribed erroneously



RAPID DIAGNOSTICS: STOPPING UNNECESSARY USE OF ANTIBIOTICS

THE REVIEW ON ANTIMICROBIAL RESISTANCE*

CHAired BY JIM O'NEILL

OCTOBER 2015

Review on Antimicrobial Resistance
Tackling drug-resistant infections globally

theguardian

website of the year

No antibiotics without a test, says report on rising antimicrobial resistance

Report by economist Jim O'Neill says global cost of problem could be loss of 10 million lives a year by 2050 and \$100tn a year



PharmaTimes

online

Report calls for rapid diagnostics to slash antibiotics use

Faster diagnostic tools that can distinguish between bacterial and viral infections are urgently needed in the UK to help reign in unnecessary prescriptions for



nature

International weekly journal of science

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News & Comment > News > 2016 > September > Article

NATURE | NEWS

Diagnostic developers target antibiotic resistance

Patient's immune response would tell physicians whether to prescribe.

Viviane Callier

09 October 2015

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When a patient shows up at the clinic with a cough and sore throat, there is no good way of discovering whether the infection is bacterial or viral. As a result, many clinicians prescribe

SCIENTIFIC AMERICAN

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HEALTH

A Faster Way to Diagnose Antibiotic Resistance

Novel test could slash wait time and curb inappropriate prescriptions

By Dina Fine Maron on December 17, 2014

ft.com > reports > Subscri

FT Health: Devices and Diagnostics

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December 15, 2015 6:00 am

Race is on to end unnecessary antibiotic prescriptions

Andrew Ward

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Software will beat (and support) hardware



Cost

Hardware costs more than generic antibiotics.

Software can be delivered at zero marginal cost.



Adoption

Hardware requires separate devices, maintenance and consumables.

Can't be integrated in the workflow and can't provide a definitive diagnosis.

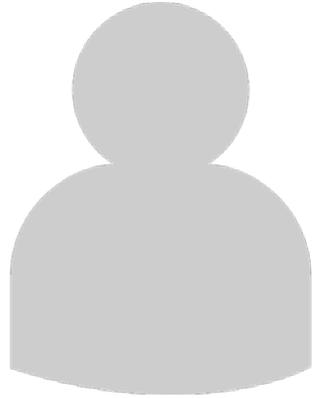


Technology

Suitable hardware diagnostics don't yet exist.

High requirements for speed, scalability, accuracy and ease-of-use.

Drivers of overprescribing



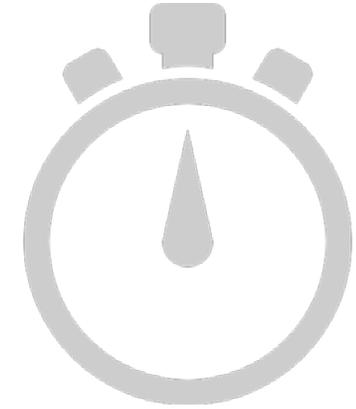
Patient Expectation

- Expect active treatment
- Want a safety net
- Poor public awareness



Clinician Confidence

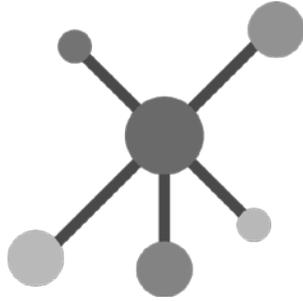
- Large degree of uncertainty
- Unbalanced risks
- Lack of feedback



Time Constraint

- Little time to educate
- No time for POC tests
- Minimal capacity for repeat appointments/follow-up

We're combining three methodologies



+



+



Decision support

Enabling complex empirical decisions whilst maintaining clinical freedom

Behavioral nudges

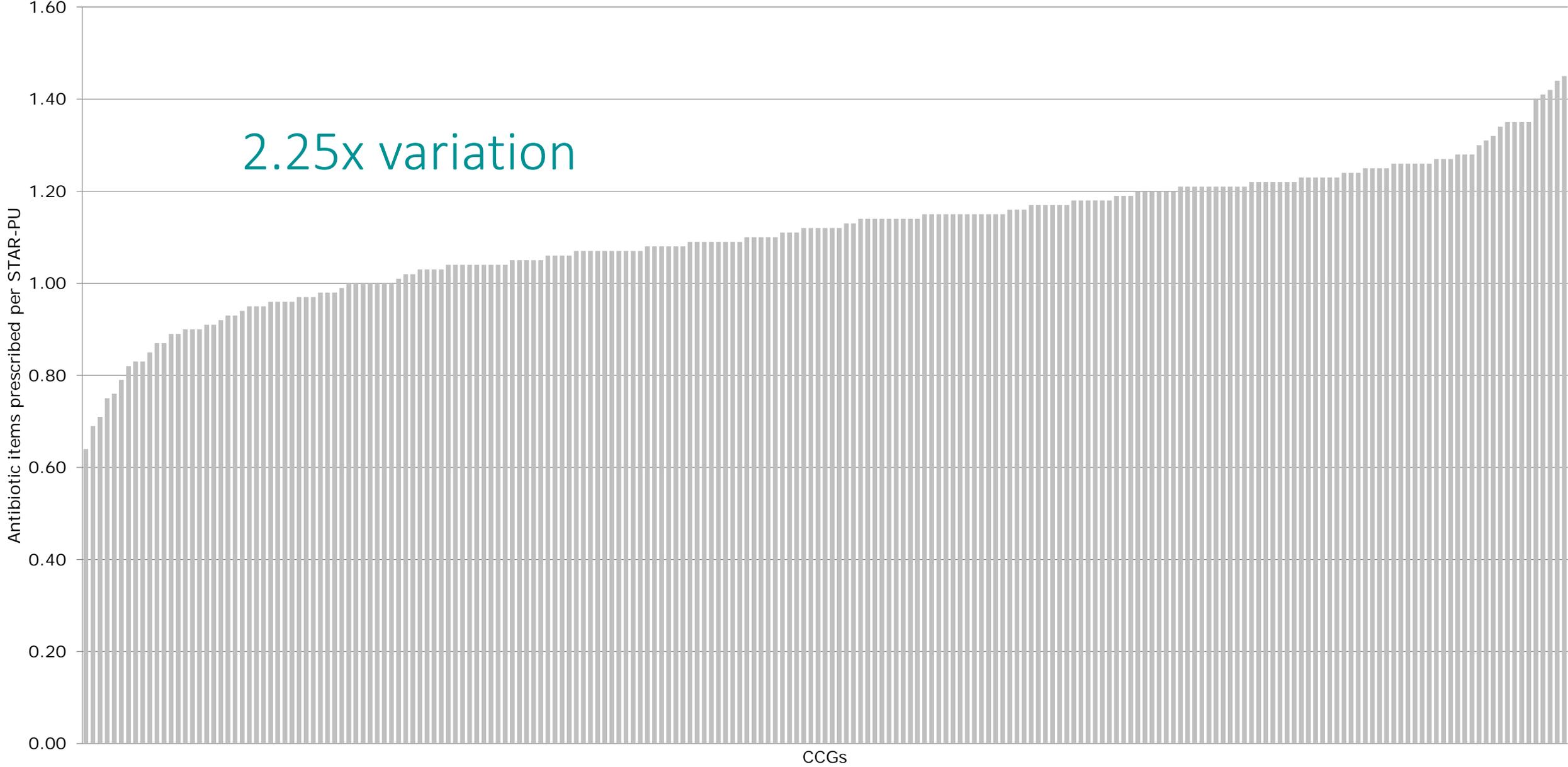
Influencing decisions at the right point and in the right way whilst helping clinicians meet patient expectations

Data science

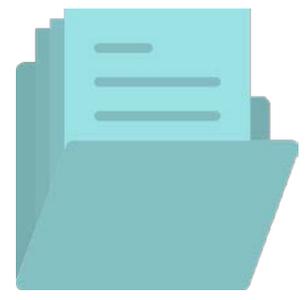
Synthesizing existing and new data sources to allow self-learning treatment decisions

Prescribed antibiotic items by Clinical Commissioning Group

2.25x variation



Medical history



Presenting symptoms



Treatment given



Clinical outcome

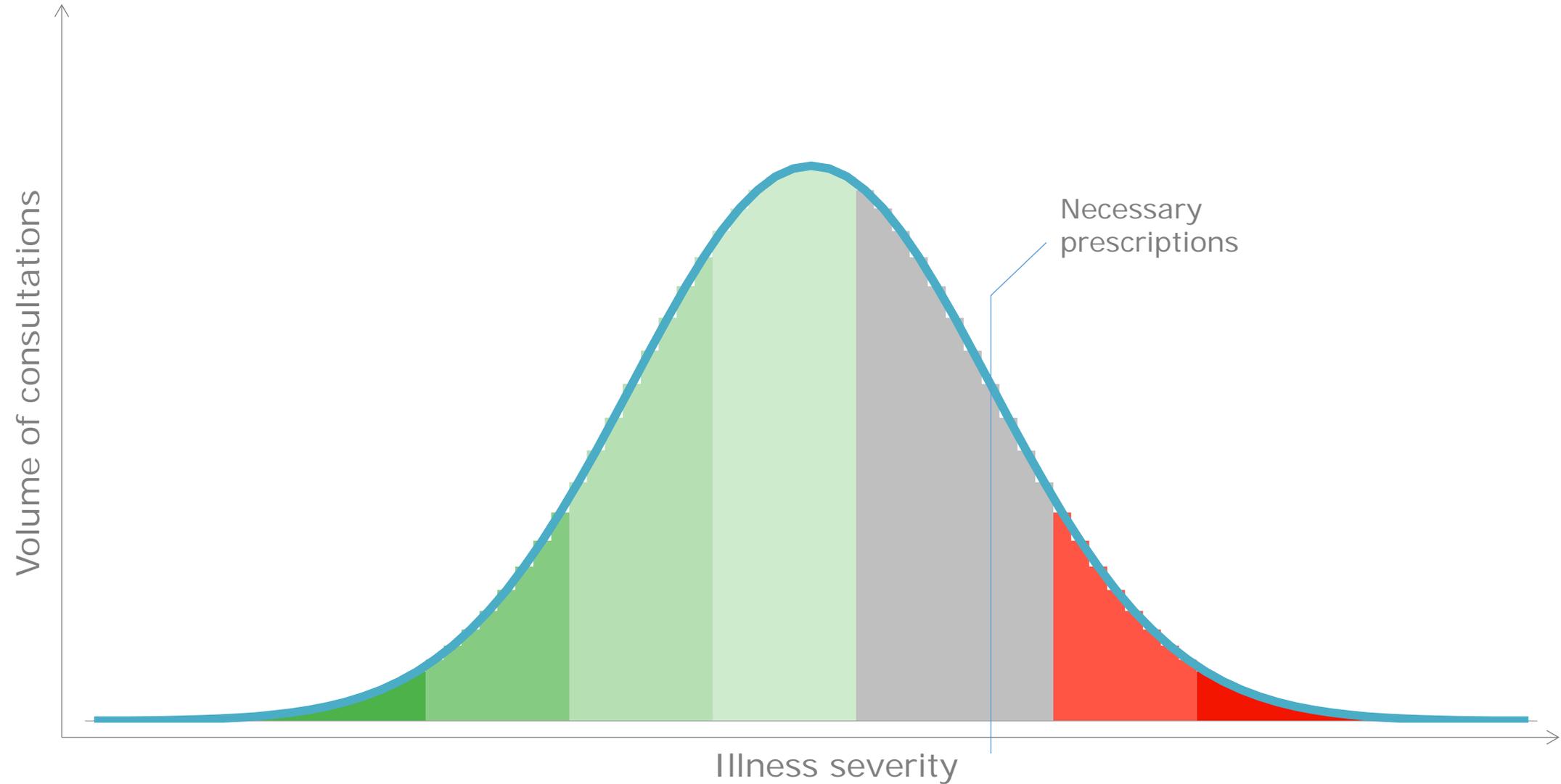


accuRx.
dataset



Optimise for
outcomes

Prescribing Accuracy





accuRx.
Chain



accuRx.
Florey



accuRx.
Fleming

Decision support based on existing guidelines, integrated into the workflow.

To gain adoption and gather structured data.

Remote SMS management to offer an alternative to antibiotics and provide a safety net.

To gather outcomes and adapt the workflow.

Data-driven rapid diagnostic that is patient-specific and self-learning.

To eliminate inappropriate antibiotic use.

accuRx Chain

Patient advice:

The image shows a text message from 'accuRx' to a user named Joe. The message contains a link to guidelines for managing an acute sore throat. Below the message is a screenshot of the mobile website 'accuRx.me'. The website displays a personalized greeting 'Good afternoon, Joe.' and provides management guidelines for an acute sore throat infection. The guidelines include taking ibuprofen or paracetamol, drinking plenty of fluids, eating cool soft foods, and avoiding smoking.

Text Message Today 13:05

Hi Joe, here is a link to guidelines for management of your Sore Throat - Acute. accuRx.me/api/guidelines/x5rq4j

Back to Messages 13:06

accuRx.me

accuRx

Good afternoon, Joe.

Below you will find guidelines for management of your infection (Sore Throat - Acute).

Take ibuprofen or paracetamol – paracetamol is better for children and for people who can't take ibuprofen (note that children under 16 should never take aspirin)

Drink plenty of cool or warm fluids, and avoid very hot drinks

Eat cool, soft foods

Avoid smoking and smoky places

Smart formulary:

The image shows a screenshot of a clinical system's smart formulary. The patient is identified as Anthony Bennett, born 07/08/1956 (60y), male, with NHS number 7880631084. The condition is UTI. The formulary asks two questions: 'Has the patient had a course of Trimethoprim in the last year?' (False) and 'Is the patient currently taking methotrexate or phenytoin?' (False). Two drug recommendations are shown in red boxes: Nitrofurantoin 50mg tablets (1 tablet 4 times a day, 28 quantity, 7 days duration) and Trimethoprim 200mg tablets (1 tablet twice a day, 14 quantity, 7 days duration). The background shows a list of medical history items, including consultations and lab results.

EMIS Web Health Care System - Partner Test CD829391 - 29391

Anthony Bennett Born 07/08/1956 (60y) Gender Male NHS No. 7880631084

Condition: UTI

Has the patient had a course of Trimethoprim in the last year?
 False True

Is the patient currently taking methotrexate or phenytoin?
 False True

Drug: Nitrofurantoin 50mg tablets
Dosage: 1 tablet 4 times a day
Quantity: 28
Duration: 7 Days

Drug: Trimethoprim 200mg tablets
Dosage: 1 tablet twice a day
Quantity: 14
Duration: 7 Days

accuRx.Florey



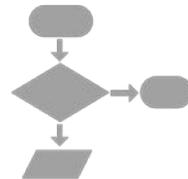
Active Management

Meeting patient expectations for active treatment without prescribing, whilst providing GPs with a safety net



Course Adherence Nudges

Engaging patients in the management of infection and improved medication compliance



Smart Delayed Prescribing

Delaying the decision point to prescribe and unlocking prescriptions on logic chosen in the consultation e.g. patient reported symptoms or lab results



Outcomes Collection

Collecting an unbiased set of patient-reported outcomes, linked to their consultation information

●●○○○ vodafone UK 10:52 61%

< Messages Park View Health Centre Details

Today 10:51

Good morning, Jack. How is your sore throat feeling today? Simply reply "1" if it is better, "2" if it feels same or "3" if it feels worse.

3

Sorry to hear that. Are your tonsils swollen? Text back "YES" or "NO". Reply "NOT SURE" if you need help answering this question.

Yes

Okay. Do you have a cough today? Text back "YES" or "NO".

No

Okay. What is your temperature?. Text back the full number from your thermometer, for example "37.1", or "DONT KNOW" if you don't have access to a thermometer.

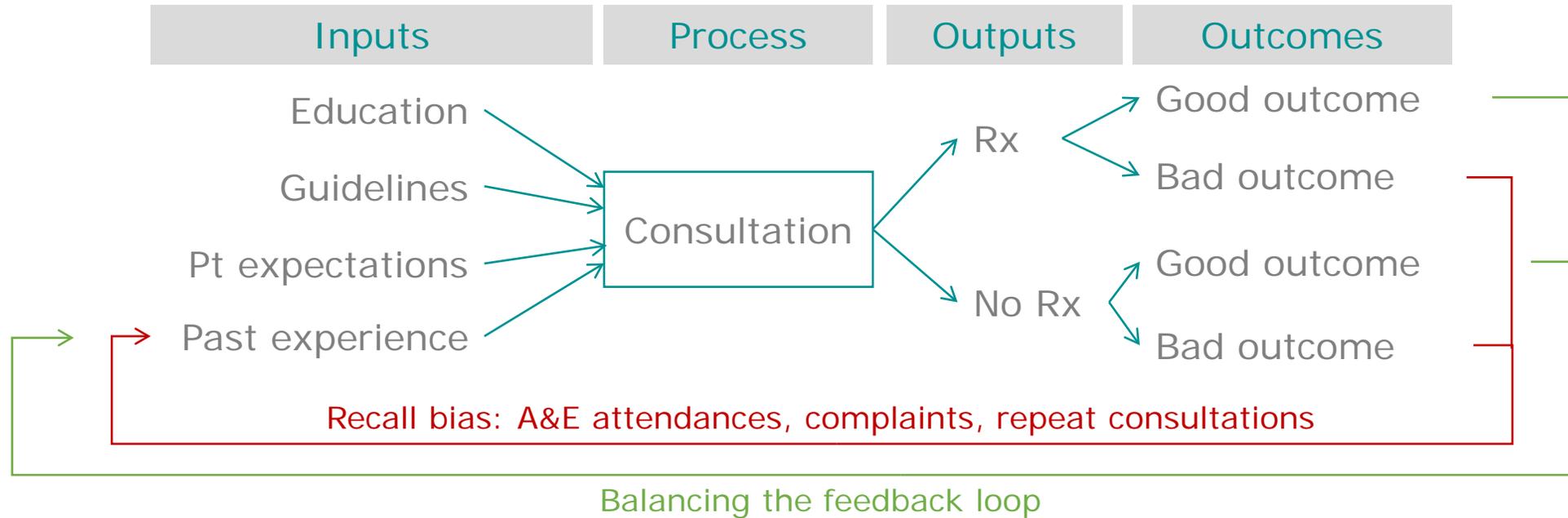
38.2

It sounds like a bacterial infection might be causing your sore throat. We have prescribed some antibiotics to be taken 4 times a day for 10 days. It's very important that you take every dose, even once you feel better. Follow this link to get your prescription and find your nearest pharmacy: nhs.uk/eprescribe/8d45x9c1

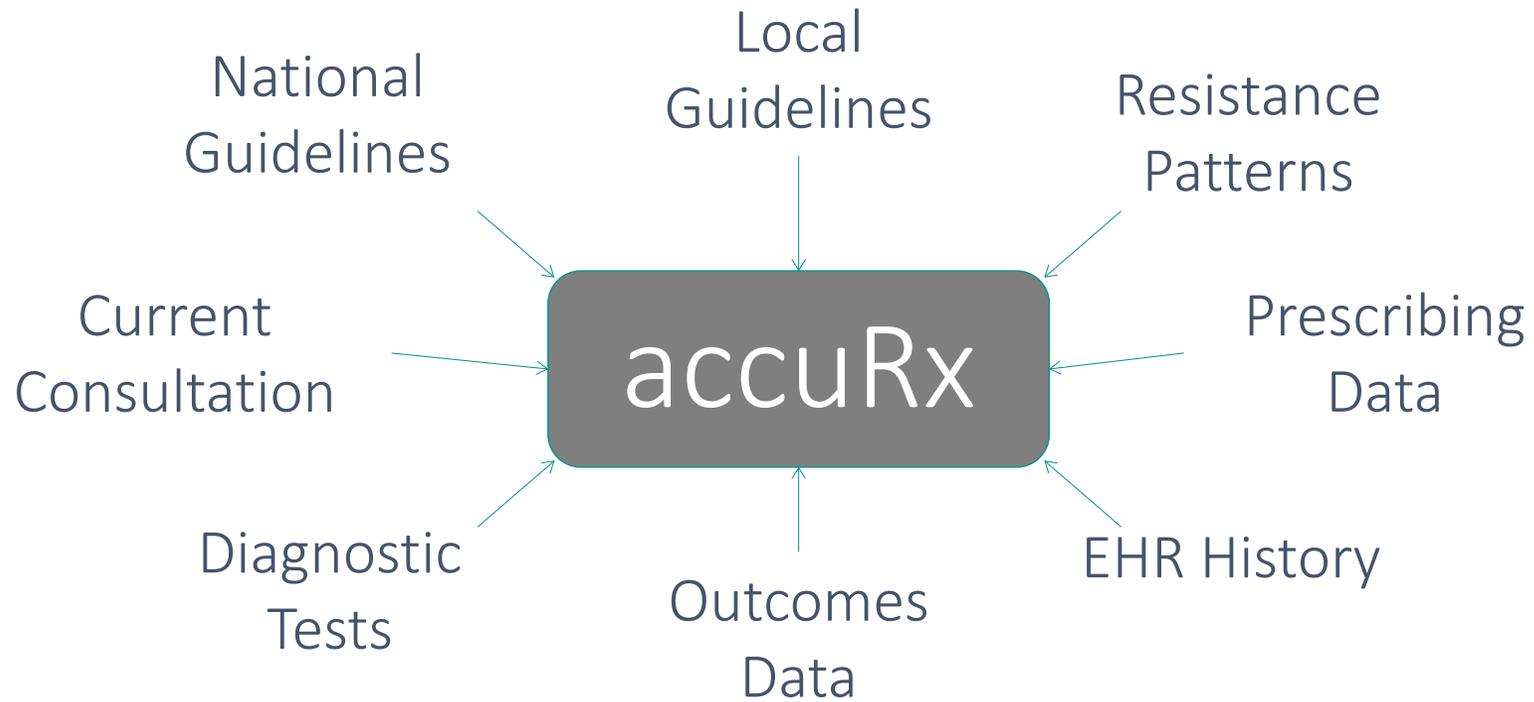
Text Message Send



Outcomes Collection



accuRx Fleming



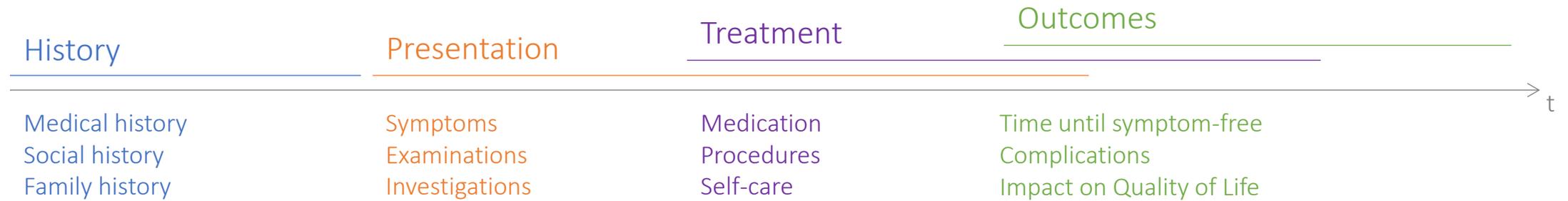
GP benefits: Operational support

- Time saving
- Skill mix support
- Improved prescribing
- Improved patient safety
- Improved patient experience
- Improved audit trail

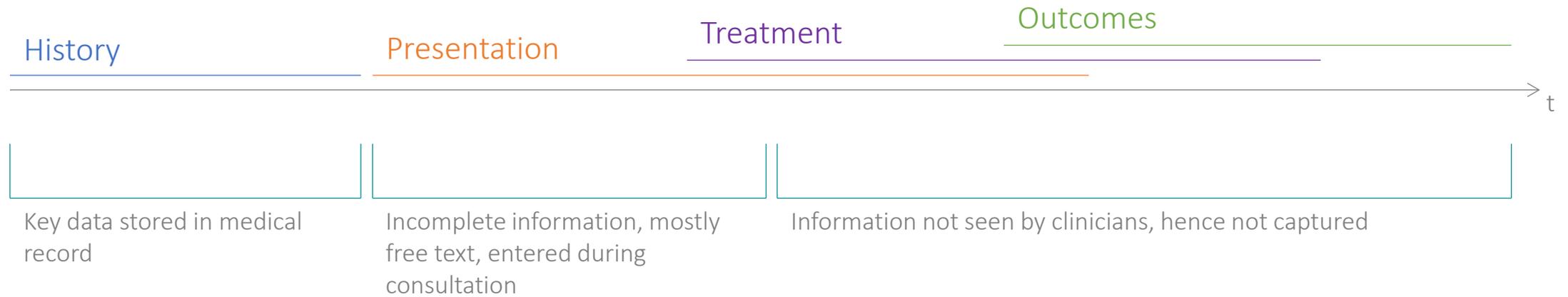
Challenges

- Converting political priorities to local ones
- Lack of market or incentives
- Focus on diagnostics
- Iterating in healthcare
- Getting into the workflow
- Focus!
- Guideline limitations

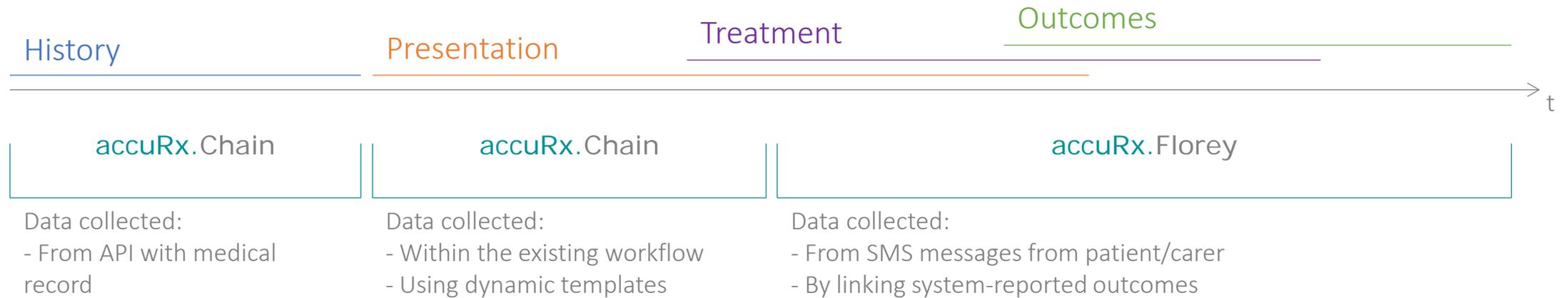
Each datapoint is a timeline of events



Data availability is limited and quality is low



We collect this data



Latent Variable Modeling: PCA

