

Cognitive Bias, Heuristics, Nudging and Behavioural Insights in Medicine

Dr Alex Gyani



What does the next hour have in store?



What do we know about human behaviour?



What does this mean for surgeons?

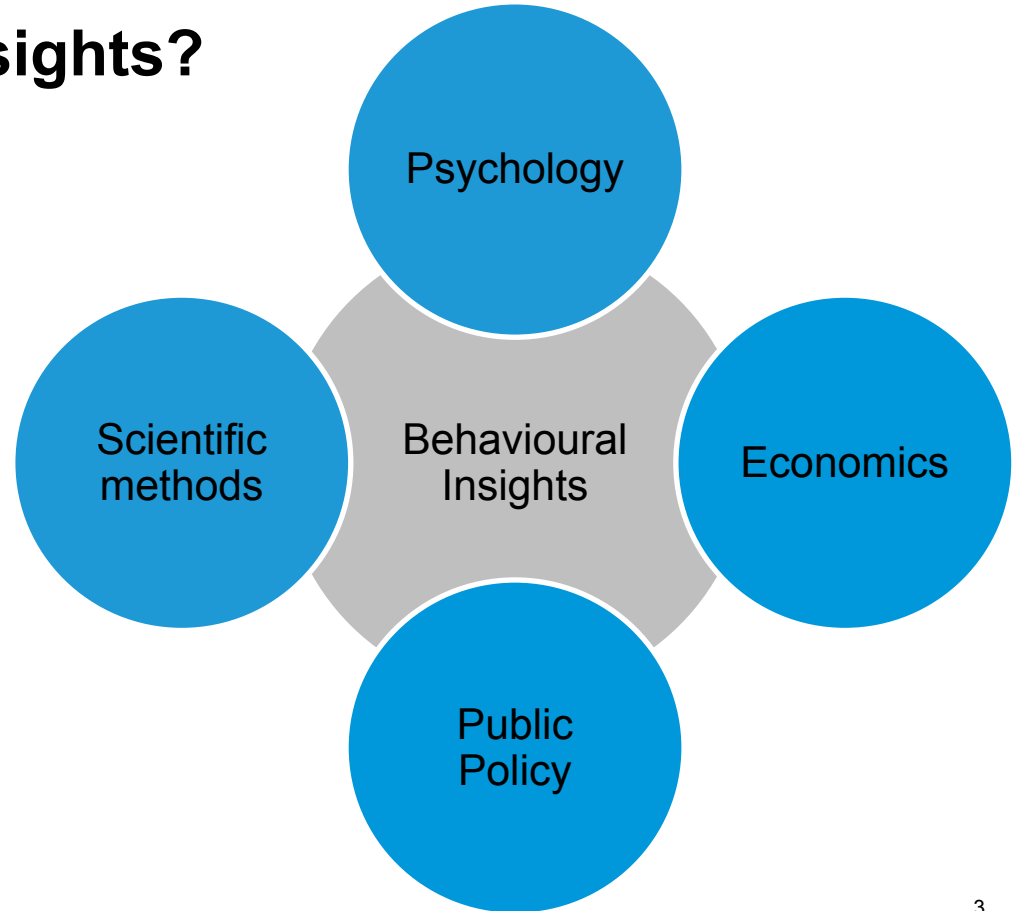


How can **you** apply behavioural insights to public health and the wider public health system?



What are Behavioural Insights?

Understanding how people behave in practice will help us design better policies and services



We need to think different about behaviour

System 1

Fast thinking/Automatic
intuitive, effortless

2x2

Taking your daily
commute

*"It turns out that the environmental effects on
behavior are a lot stronger than most people
expect"*

Daniel Kahneman, Nobel Laureate



System 2

Slow thinking/Reflective
deliberate, analytic

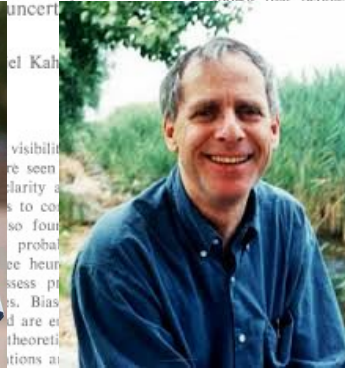
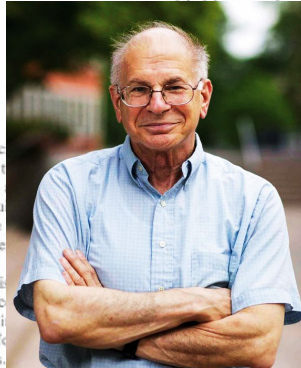
24x17

Planning a trip overseas

System 1 is often affected by biases and heuristics

Judgment under Uncertainty: Heuristics and Biases

Biases in judgments reveal some heuristics of



Representativeness

Many decisions concerning uncertain events such as the future value of an investment, the gain or loss from a bet, are usually made as "I think..." "it is so forth. One of the main problems in making uncertain numerical forecasts is the probability of errors. How do people assess the probability of an uncertain event or the value of an uncertain quantity? This article shows that people rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations. In general, these heuristics are quite

Many of the probabilistic questions with which people are concerned belong to one of the following types: What is the probability that object A belongs to class B? What is the probability that

(for example, farmer, salesman, airline pilot, librarian, or physician)? How do people order these occupations from most to least likely? In the representativeness heuristic, the probability that Steve is a librarian, for example, is assessed by the degree to which he is representative of, or similar to, the stereotype of a librarian. Indeed, research with problems of this type has shown that people order the occupa-

and by similarity way (1). This apparent of probability errors, because similarity, is not in factors that should probability.

for probability of factors that have representativeness but effect on probability, or base-rate comes. In the case of, the fact that farmers than librarians should enter estimate of the is a librarian Considerations of

base-rate frequency, however, do not affect the similarity of Steve to the stereotypes of librarians and farmers. If people evaluate probability by representativeness, therefore, prior probabilities will be neglected. This hypothesis was tested in an experiment where prior probabilities were manipulated (1). Subjects were shown brief personality

*"Heuristics are highly economical and usually effective, but they lead to **systematic** and **predictable errors**."*

Example Biases

Framing

Anchoring

Present bias

Vividness

Status quo bias

Diagnosis momentum

Search satisficing

Curse of knowledge

Déformation professionnelle

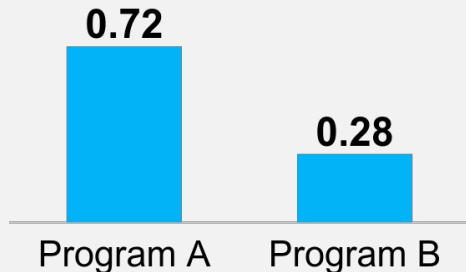
Framing can be a powerful bias and affects seasoned decision makers

“Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows...”

Problem 1

If Program A is adopted, 200 people will be saved.

If Program B is adopted, there is $\frac{1}{3}$ probability that 600 people will be saved, and $\frac{2}{3}$ probability that no people will be saved.



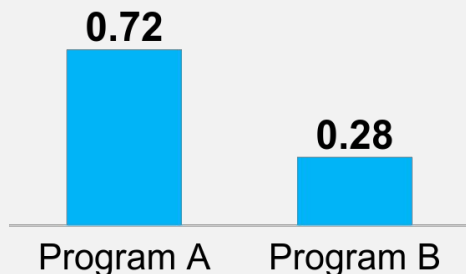
Framing can be a powerful bias and affects seasoned decision makers

“Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows...”

Problem 1

If Program A is adopted, **200 people will be saved**.

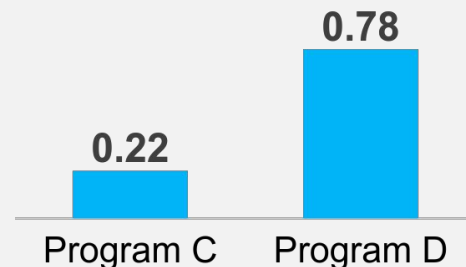
If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.



Problem 2

If Program C is adopted, 400 people will die.

If Program D is adopted there is **1/3 probability that nobody will die**, and 2/3 probability that 600 people will die.



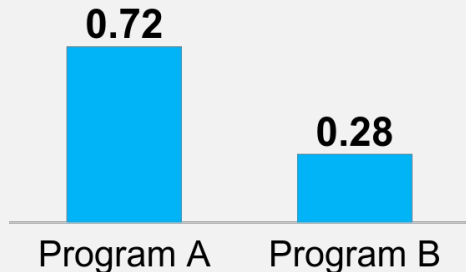
Framing can be a powerful bias and affects seasoned decision makers

“Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows...”

Problem 1

If Program A is adopted, **200 people will be saved**.

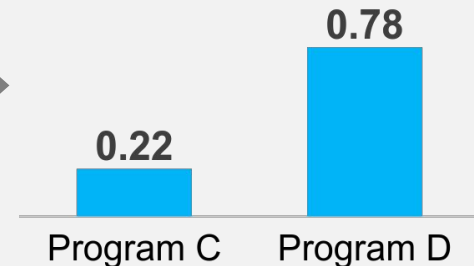
If Program B is adopted, there is $\frac{1}{3}$ probability that 600 people will be saved, and $\frac{2}{3}$ probability that no people will be saved.



Problem 2

If Program C is adopted, 400 people will die.

If Program D is adopted there is $\frac{1}{3}$ probability that **nobody will die**, and $\frac{2}{3}$ probability that 600 people will die.



Preference Reversal

How does this apply to surgeons?

Framing: Does the way in which you present a procedure affect the likelihood that a patient goes through with it?

Anchoring: Is one piece of a patient's history guiding your treatment plan?

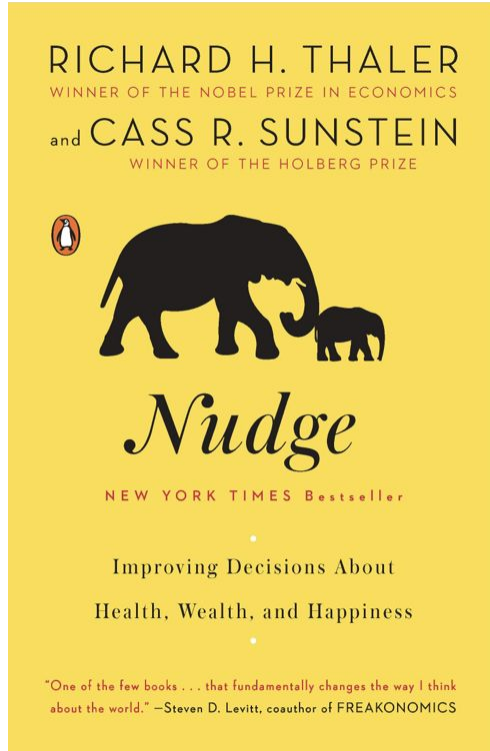
Commission bias: What are the costs of being biased towards action?

Déformation professionnelle: What problems are you solely viewing through a surgeon's lens?



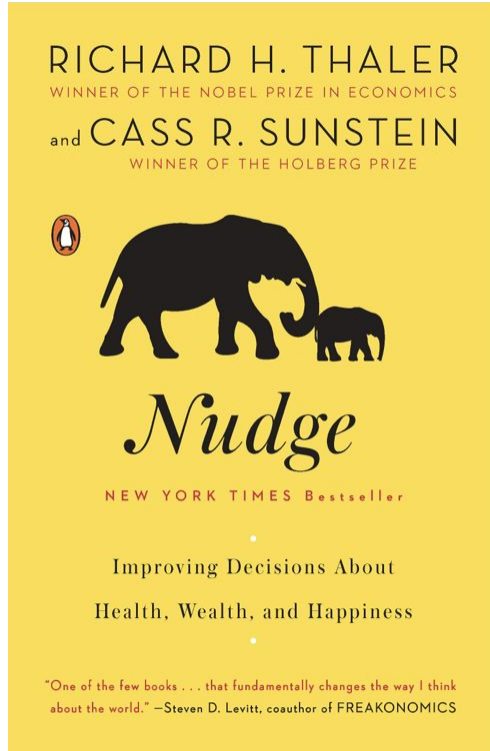
What can we do about it?

What's a nudge?



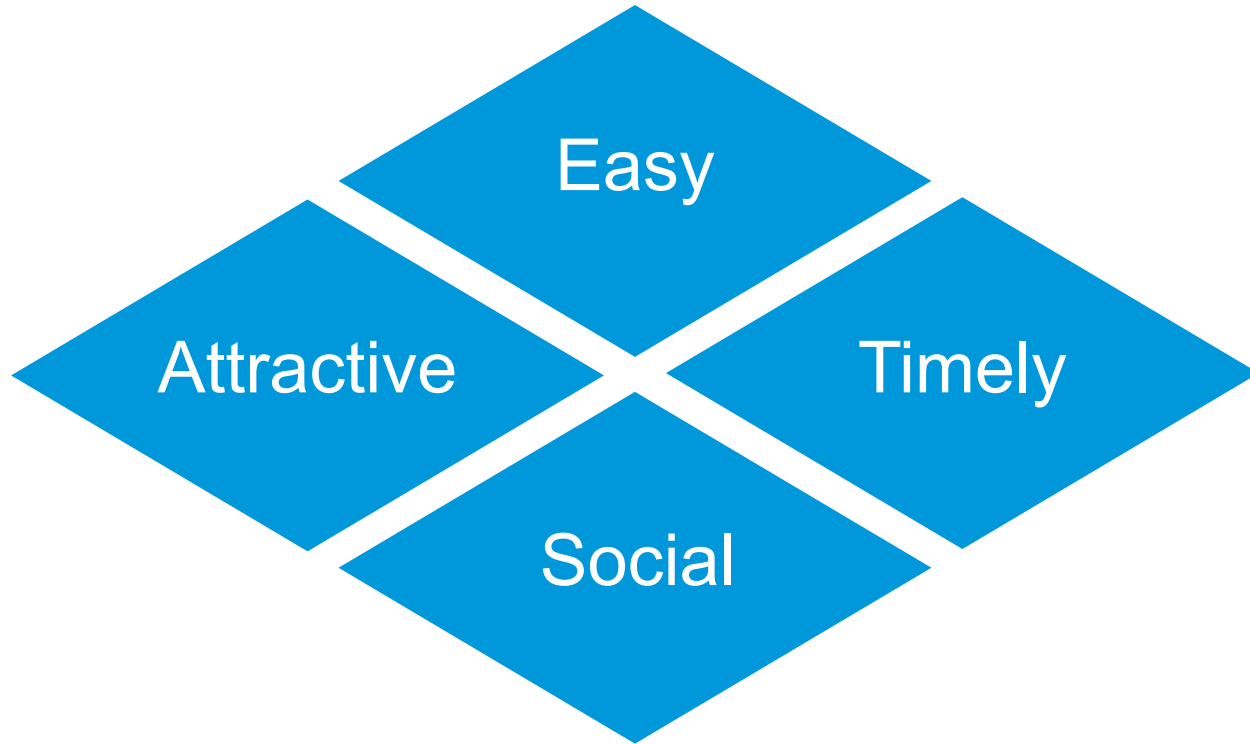
“any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”

What's a nudge?



“To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting the fruit at eye level counts as a nudge. Banning junk food does not.”

The EAST Framework



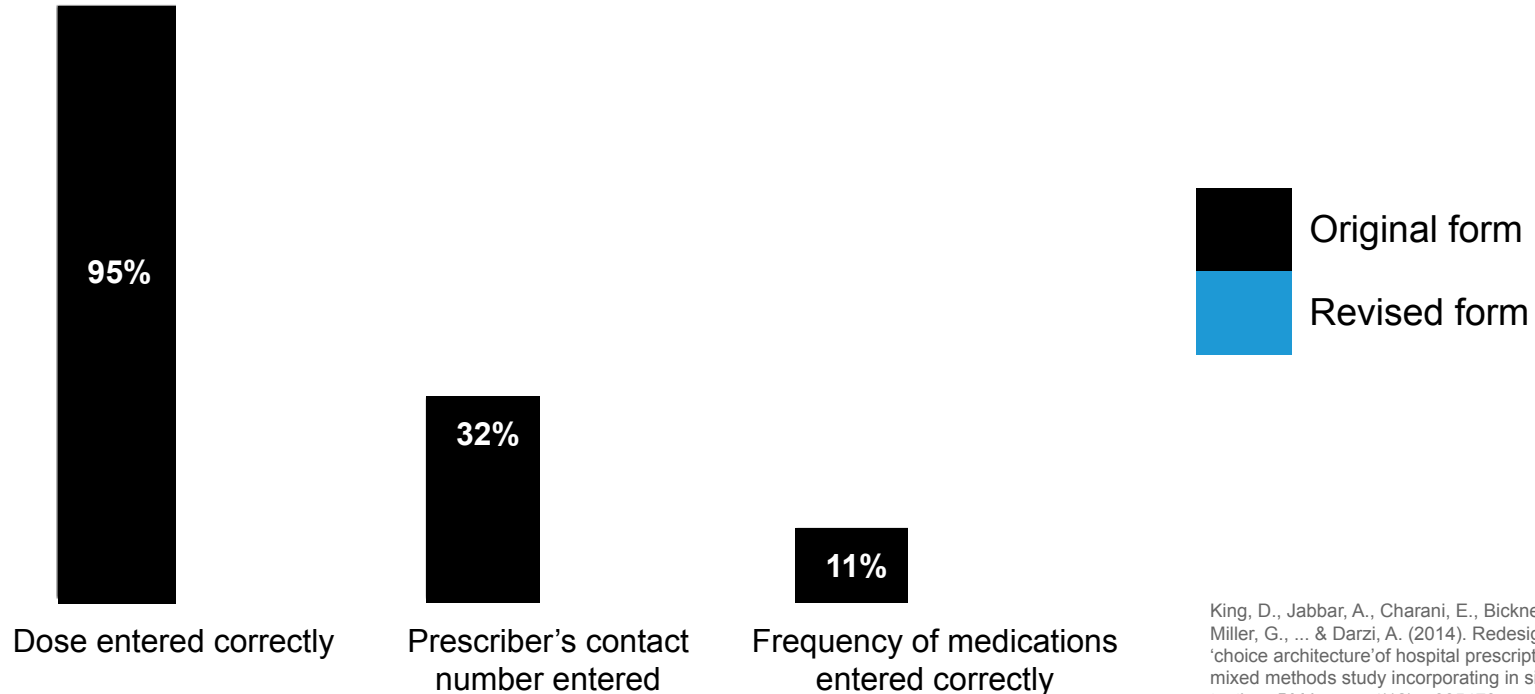
Designing out bad handwriting

DRUG (Approved Name) <i>SEVERE CAP</i>			Effect <i>OG</i>	<i>X</i>							
<i>Benzylpenicillin</i>			Switch <i>12</i>								
Route <i>IV</i>	Dose <i>1-2g</i>	Date <i>14/03</i>	Pharm.	Supplier <i>18</i>							
Signature <i>A. Doctor Bleep</i>											
DRUG (Approved Name) <i>Severe CAP</i>											
<i>Clarithromycin</i>											
Route <i>IV</i>	Dose <i>500mg</i>	Date <i>14/03</i>									
Signature <i>A. Doctor Bleep</i>											

REGULAR PRESCRIPTIONS										Date:	
MEDICINE (Approved name)											
<i>EXAMPLE</i>											
D	O	S	E	microgram			mg	g	units	Other	
1	5	0									
OD BD <i>TDS</i> QDS Other				Route <i>PO</i>							
Name <i>A. Doctor</i>			Signature <i>[Signature]</i>			Bleep <i>4528</i>					
New <input checked="" type="checkbox"/>	Start date <i>31/03</i>			Additional information <i>After food</i>					Pharmacist Initials <i>A. Name</i>		

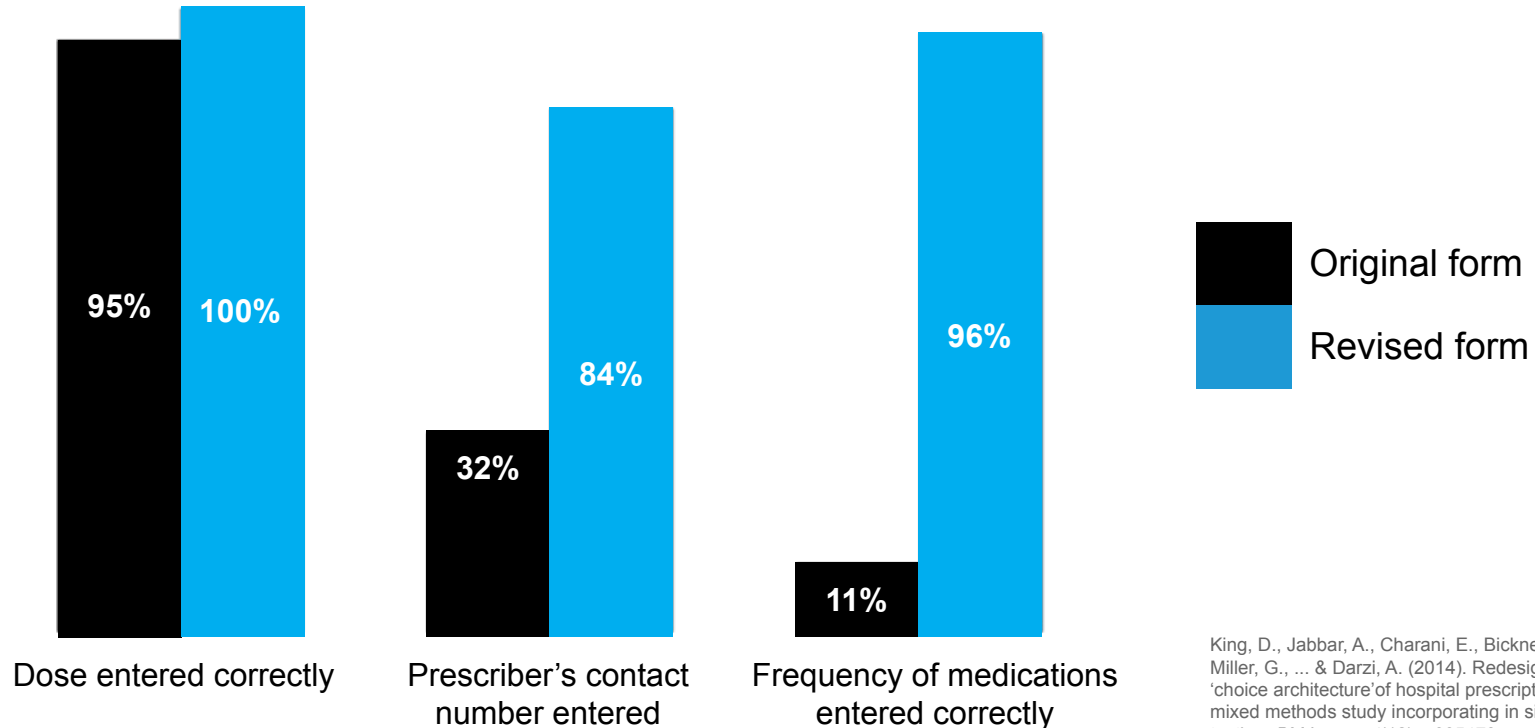
<i>10</i>	<i>CSMH</i>	<i>X</i>	<i>CS</i>				
<i>08</i>							
<i>12</i>	<i>CS</i>	<i>OG</i>	<i>CS</i>				
<i>18</i>	<i>MH</i>	<i>OG</i>	<i>MH</i>				
<i>22</i>							

The new form had a huge impact on the error rate



King, D., Jabbar, A., Charani, E., Bicknell, C., Wu, Z., Miller, G., ... & Darzi, A. (2014). Redesigning the 'choice architecture' of hospital prescription charts: a mixed methods study incorporating in situ simulation testing. *BMJ open*, 4(12), e005473.


The new form had a huge impact on the error rate



King, D., Jabbar, A., Charani, E., Bicknell, C., Wu, Z., Miller, G., ... & Darzi, A. (2014). Redesigning the 'choice architecture' of hospital prescription charts: a mixed methods study incorporating in situ simulation testing. *BMJ open*, 4(12), e005473.



Using Behavioural Insights in Public Health



Antimicrobial resistance (AMR) is a growing global threat. A recent UN report suggests 10 million deaths each year by 2050 with the status quo.

New Zealand has one of the highest rates in the OECD.

Most prescribing of antibiotics is in the community by GPs.

There is also evidence that populations are being under prescribed antibiotics, most notably Māori and Pasifika patients.

Ten threats to global health in 2019



Department
of Health

From the Chief Medical Officer,
Professor Dame Sally C Davies FRS
FMedSci

Richmond House T: +44 (0)20 7210 4850
79 Whitehall F: +44 (0)20 7210 5407
London E: sally.davies@dh.gov.uk
SW1A 2NS W: www.gov.uk

30th March 2015

NOTE TO PRACTICE MANAGERS: PLEASE FORWARD IMMEDIATELY TO GP ADDRESSED

Dear Mr Sample

Antibiotic usage in your practice

Antimicrobial resistance is a serious and growing threat to our health. Reducing unnecessary prescriptions in primary care may help prevent a public health catastrophe.

The great majority (80%) of practices in Birmingham & the Black Country prescribe fewer antibiotics per head than yours.*

Many practices are already taking action to reduce antibiotic prescriptions while safeguarding patients' health. Please join them by taking three simple actions:

1. Give patients advice on self-care instead – you can use the leaflet enclosed or search online for the "TARGET antibiotics toolkit".
2. Consider offering a back-up (delayed) prescription instead – this could be post-dated or collected by the patient a few days later if still necessary.
3. Talk to other prescribers in your practice to ensure they are also acting – data on prescribing is recorded at practice level.

I know that prescribers are aware of this problem and that prescribing is not a simple issue. But there are small changes we can all make that will have a big effect on everyone's health.

Please join us in reducing antibiotic use.

Yours,

**PROFESSOR DAME SALLY C DAVIES
CHIEF MEDICAL OFFICER**

**“The great majority
(80%) of practices in
London prescribe
fewer antibiotics per
head than yours.”**

* Your practice's prescribing data are available online. Data were taken from <http://www.hscic.gov.uk/gpprescribingdata> and adjusted to take into account patient load and demographics. The 80% figure excludes outliers judged to be created by measurement error and does not include out-of-hours services. For more information on the consequences of antimicrobial resistance, see the UK 5 Year Antimicrobial Resistance Strategy.

Intervention: We sent letters to the top 30% of prescribers in each region, building on past trials in the UK and Australia

Gives clear actions to
reduce unnecessary
prescribing

Trusted messenger

**HEALTH QUALITY & SAFETY
COMMISSION NEW ZEALAND**
Ngā Hōuwhiri / Houwhiri o Aotearoa

[GP Name]
[Address Line 1]
[Address Line 2]
[Suburb] [Region] [Postcode]
2nd July 2019

Tēnā koe Dr [GP_Surname],

This is a call to action, and we need your help.

You prescribe more antibiotics than 83% of GPs in Auckland DHB.

Antimicrobial resistance is a serious and growing threat. I know that resistance is a complex issue with many factors, yet 85-95% of prescribing occurs in the community. If GPs like you and your peers reduce unnecessary prescriptions, we will help prevent a public health crisis.

Your antibiotic prescribing rate for 2018 is shown below.*

Number of patients given ABs per 100 dispensed anything

Category	Value
GPs in your DHB	15.2
You	21.3

While some antibiotics are needed, many GPs are reducing their unnecessary prescribing by doing the following:

1. Advising patients on self-care instead, and explaining to them why antibiotics are not suitable for some infections.
2. Talking to other prescribers in the practice to ensure they are also acting.
3. Receiving an audit of their prescribing, by visiting www.hqsc.org.nz/audits.

Ngā mihi,

Janice Wilson
Dr Janice Wilson, HQSC Chief Executive

* The back page of this letter describes how your prescribing rate was calculated, along with a detailed breakdown. To discuss this letter please email [\[Email address\]](mailto:[Email address]).

Uses social norms: “*You prescribe more antibiotics than 83% of GPs in Auckland DHB*”

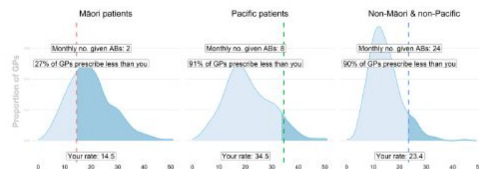
Our innovation: adding ethnicity graphs on the back page to address underprescribing to at-risk groups

Ethnicity-specific graphs to allow under-prescribers to see



Your antibiotic prescribing to specific demographic groups*

We know Māori and Pacific patients may need more antibiotics than other New Zealanders. Below is your prescribing rate to different demographic groups, and for GPs in your DHB.



More details on your antibiotic prescribing rate*

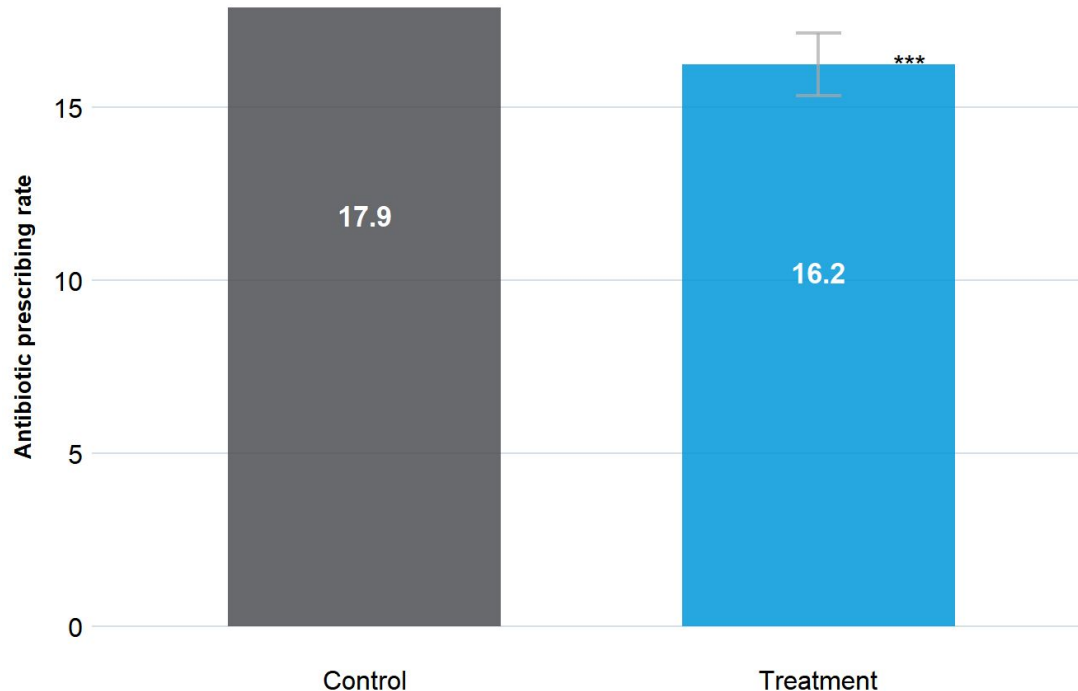
This table shows your prescribing rate for key antibiotics included in the figures above.

Chemical	Monthly no. of people dispensed the AB	Your prescribing rate	Average GP prescribing rate in your DHB
Amoxicillin	18	14.1	7.1
Amox. with clavulanic acid	3	2.3	4.2
Doxycycline	8	6.8	2.0
Roxithromycin	1	1.0	1.3
Trimethoprim	0	0.0	0.5
Erythromycin ethyl succinate	1	1.1	0.8
Co-trimoxazole	0	0.3	1.0
Cefaclor monohydrate	1	0.8	0.6
Penicillin V	2	1.4	0.2

Detail on specific antibiotics prescribed

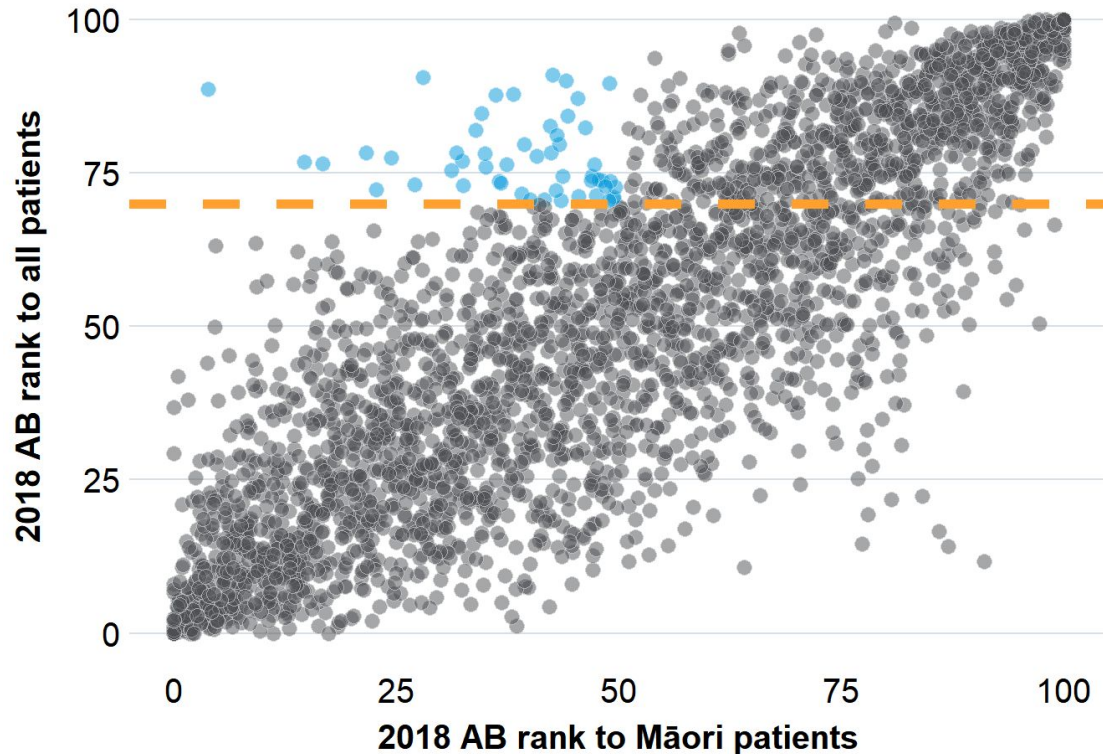
* Your rate is calculated as the number of your patients dispensed an antibiotic script per 100 patients dispensed any prescription medicine, taking the monthly average for 2018. Antibiotics included are those in indicator #4 of the Antibiotic Atlas by the Health Quality and Safety Commission, as listed in the table above. These antibiotics are commonly prescribed and their use increases in winter. Your prescribing data comes from the Pharmaceutical Collection held by the Ministry of Health, which has data on every prescription dispensed in the community. For more details on the data methodology, visit www.hqsc.govt.nz/amr-letters. This initiative is endorsed by The Royal New Zealand College of GPs, Health Quality and Safety Commission, Pharmax, the New Zealand Medical Association and the Ministry of Health.

We reduced prescribing by 9.2%

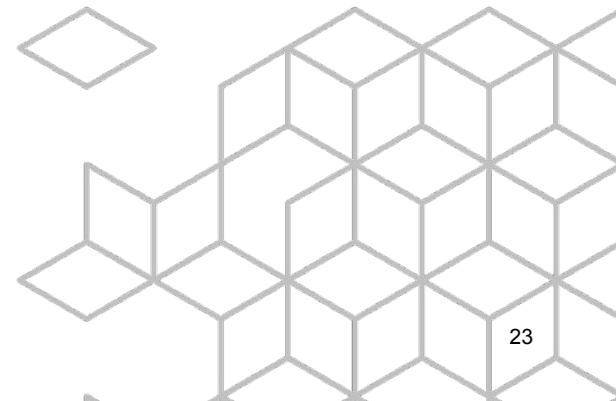


Chappell, N., Gerard, C., Gyani, A., Hamblin, R., McKree, R., Lawrence, A., ... & White, J. (2021). Using a randomised controlled trial to test the effectiveness of social norms feedback to reduce antibiotic prescribing without increasing inequities. *The New Zealand Medical Journal (Online)*, 134(1544), 13-6.

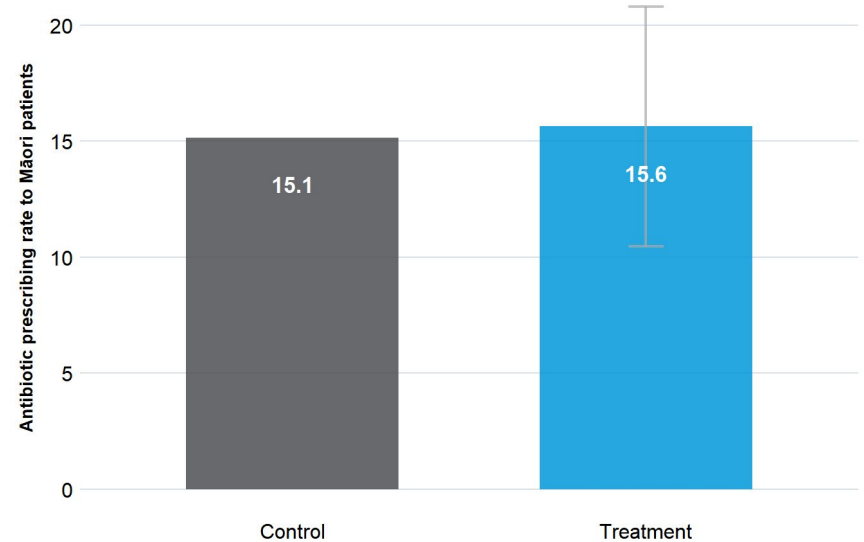
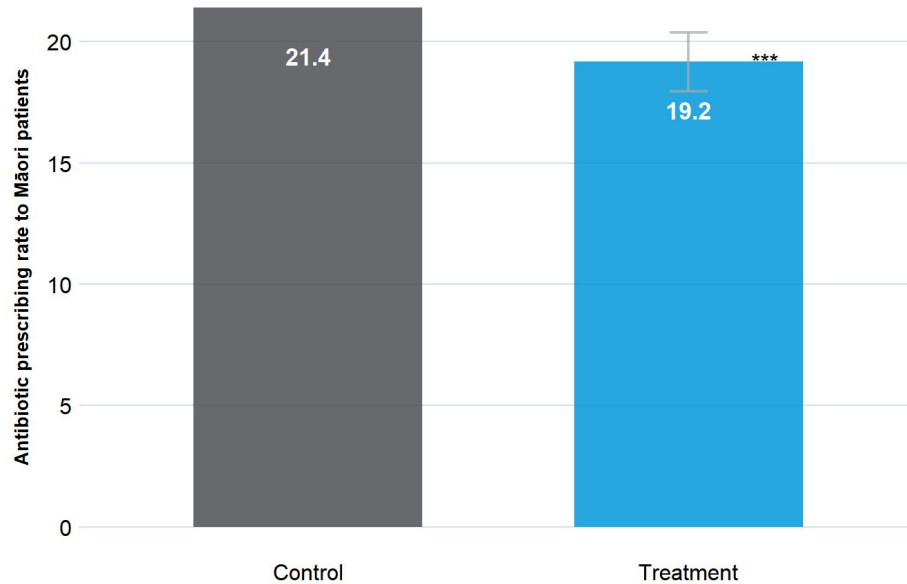
Some GPs overused antibiotics but underuse for certain groups



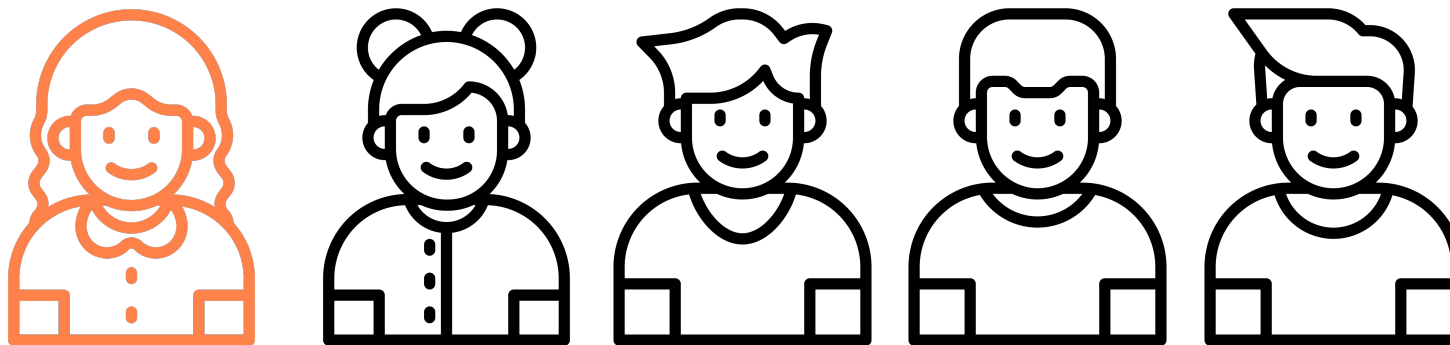
We were able to identify who the scripts were given by and then track whether or not certain groups of people were given ABs at different rates.



We saw a reduction in prescriptions for high prescribers to Māori patients, but no detectable impact for low prescribers



A multi-pronged approach to obesity

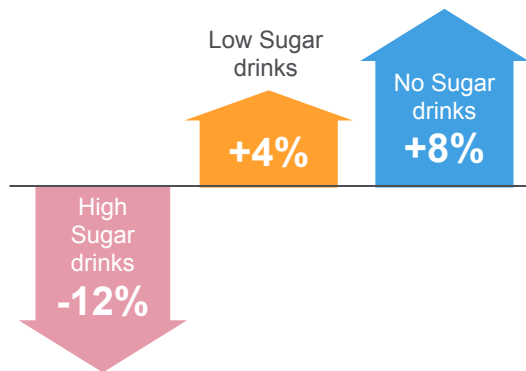


**At least 1 in 5 British children are
overweight or obese by 11**

A multi-pronged approach to obesity

Positioning out of sight

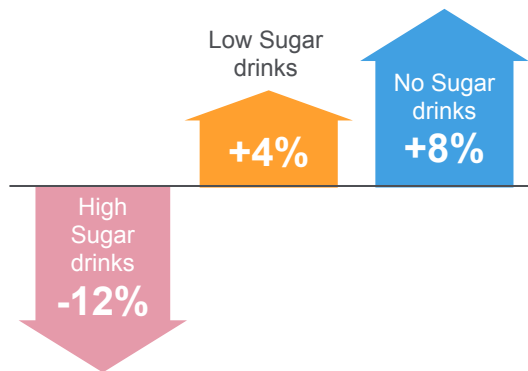
Relative impact on sales after position change



A multi-pronged approach to obesity

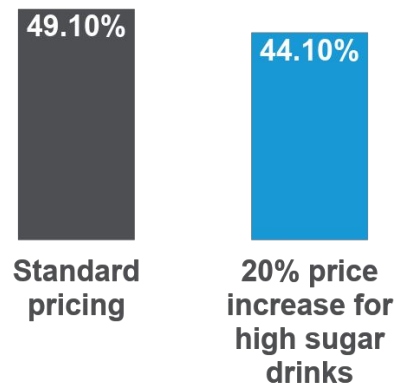
Positioning out of sight

Relative impact on sales after position change

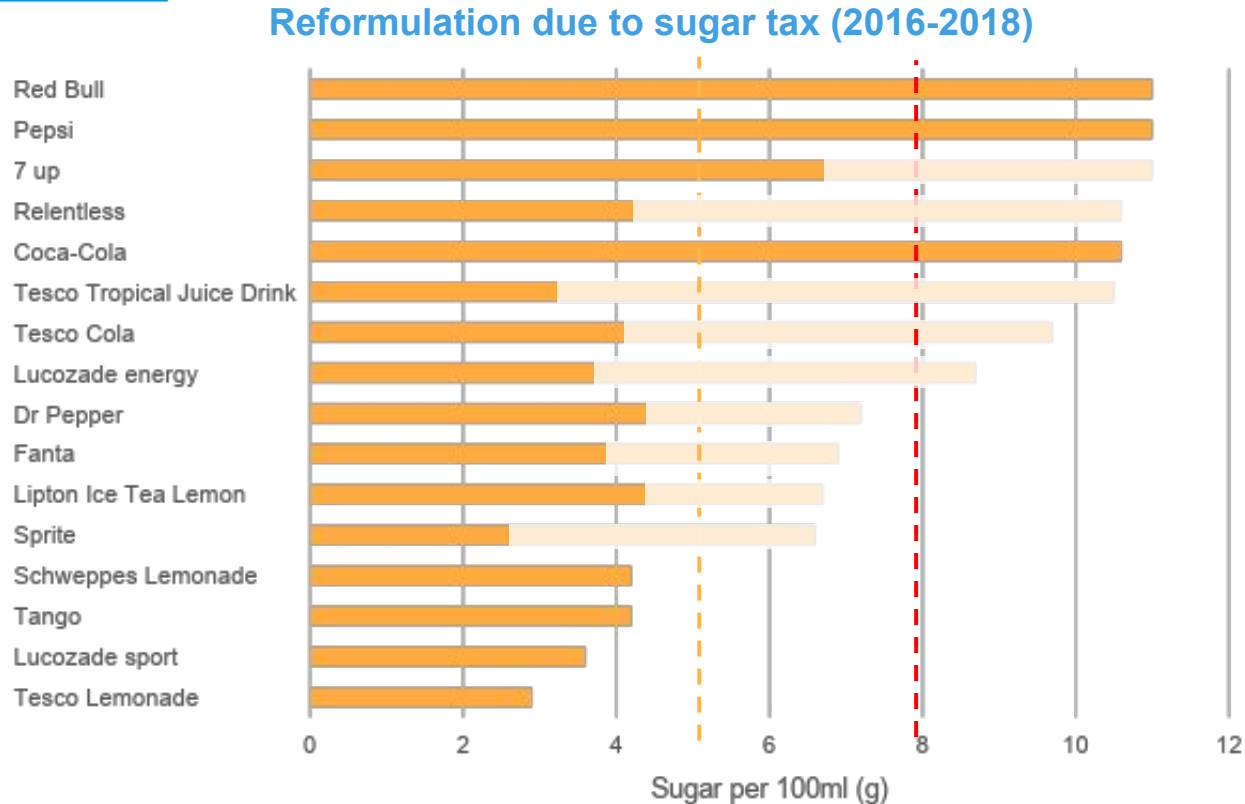


20% price increase

Proportion of high sugar drinks sold



These experiments helped inform the UK sugar tax



**11%
reduction in
sugar...**

*...before tax
even came
into effect*

Creating an effective healthcare system

Changing how we ask patients to share their data increased their understanding of how their data was used

The UK National Data Opt-Out Programme (NDOP) website **allows people to opt out of sharing their confidential patient information**. NDOP wanted to know whether they should give people:

Two choices: Share data or do not share data.

Four choices: The choice of sharing their data for:

1. Research only,
2. Planning only,
3. Both planning and research, or
4. Neither.

There was a fourfold difference in the number of people who understood the simple option and the option with four choices.

Your confidential patient information can be used for improving health, care and services, including:

- planning to improve health and care services
- research to find a cure for serious illnesses

Your decision will not affect your individual care and you can change your mind anytime you like.

I allow my confidential patient information to be used for research and planning:

☐ Yes

☐ No

Reducing NHS procurement overspend by 85 percentage points

NHS staff completed a hypothetical shopping exercise on a procurement platform. We made some amendments:



We made prices and cheaper alternatives salient



We set the cheapest delivery option as the default



We added prompts to check the order quantity



We offered swaps



We provided feedback on money spent

Participants using the standard platform had a £62,000 overspend compared to £5,000 in the treatment.

This could save up to £15 million for every £1 billion spent by NHS hospital procurement.

The screenshot shows the 'Health Advantage' procurement platform. At the top, there's a search bar with 'nasal' entered and a 'Search' button. Below the search bar, a list of suppliers is shown: Bluestone Medical, Full Circle Medical Suppliers, Horgan-Brown Medical Supplies, NextWave Suppliers, and Sky Medical. The main table displays product listings with columns for 'Name and supplier', 'Product cost', and 'Delivery options'. The first row is highlighted in green and marked as the 'Recommended cheapest option including delivery'. It shows 'Nasal Cannula with Soft Cushion Straight Tip Prongs Adult' by NextWave Suppliers for £14.52 per case of 50 items, with delivery options of +£0.00 for 5 days, +£4.95 for 2 days, and +£8.95 for next day. The second row shows the same product by Sky Medical for £15.37 per case of 50 items, with delivery options of +£0.00 for 5 days, +£0.00 for 2 days, and +£0.00 for next day. The third row shows 'Nasal cannula with curved prongs and tubing adult' by Horgan-Brown Medical Supplies for £0.28 per individual item, with delivery options of +£6.95 for 5 days, +£6.95 for 2 days, and +£12.95 for next day.

Name and supplier	Product cost	Delivery options
Recommended cheapest option including delivery Nasal Cannula with Soft Cushion Straight Tip Prongs Adult by NextWave Suppliers	£14.52 case of 50 items <i>£0.29 per individual item</i>	+ £0.00 for 5 days + £4.95 for 2 days + £8.95 for next day
Nasal Cannula with Soft Cushion Straight Tip Prongs Adult by Sky Medical	£15.37 case of 50 items <i>£0.31 per individual item</i>	+ £0.00 for 5 days + £0.00 for 2 days + £0.00 for next day
Nasal cannula with curved prongs and tubing adult by Horgan-Brown Medical Supplies	£0.28 individual item	+ £6.95 for 5 days + £6.95 for 2 days + £12.95 for next day

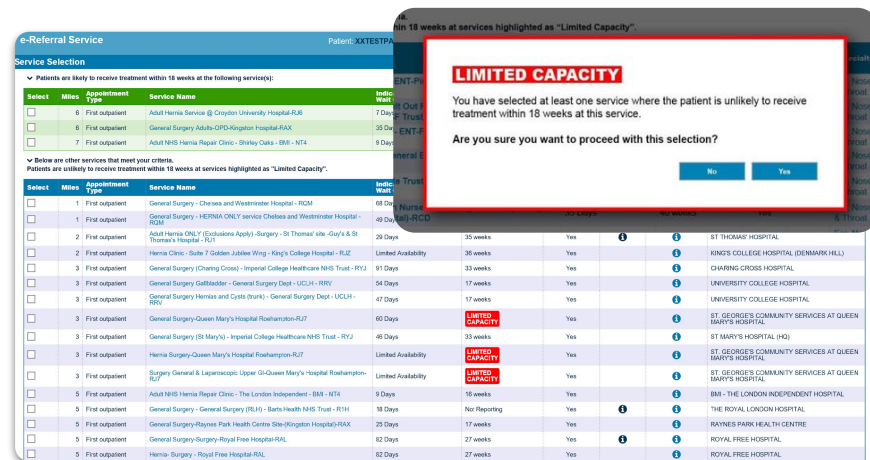
Shifting referrals away from overburdened services

More than four million people are waiting for NHS specialist care. Some wait more than a year for treatment.

We worked with NHS England and NHS Digital to redesign the patient referral system interface by:

1. Adding a **red 'Limited Capacity'** flag to overburdened clinics.
2. Adding a **green box** at the top, listing three local options with spare capacity.

These changes resulted in a **38% reduction in referrals to clinics with long waiting times**. If scaled up nationwide, these alerts could redirect up to **40,000 referrals** a month to shorter waiting lists.

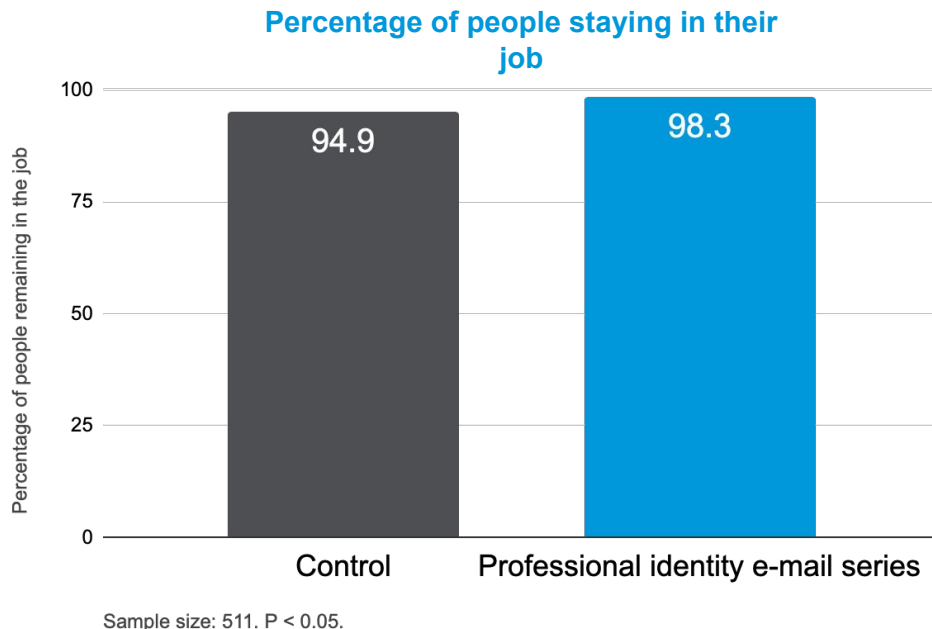


Reducing burnout and resignations among 911 call takers

Together with academics from UC Berkeley, BIT developed and tested an **intervention to reduce burnout, resignations, and sick leave** among 911 call takers and dispatchers in nine US cities.

We sent **six emails outlining success stories and positive reflections previously shared by the 911 workforce.**

“Yes, what we do can be very stressful, sad, and some calls are seemingly unbearable, but what other job allows you to just listen, type, and save a life? Not many.”



Final thoughts



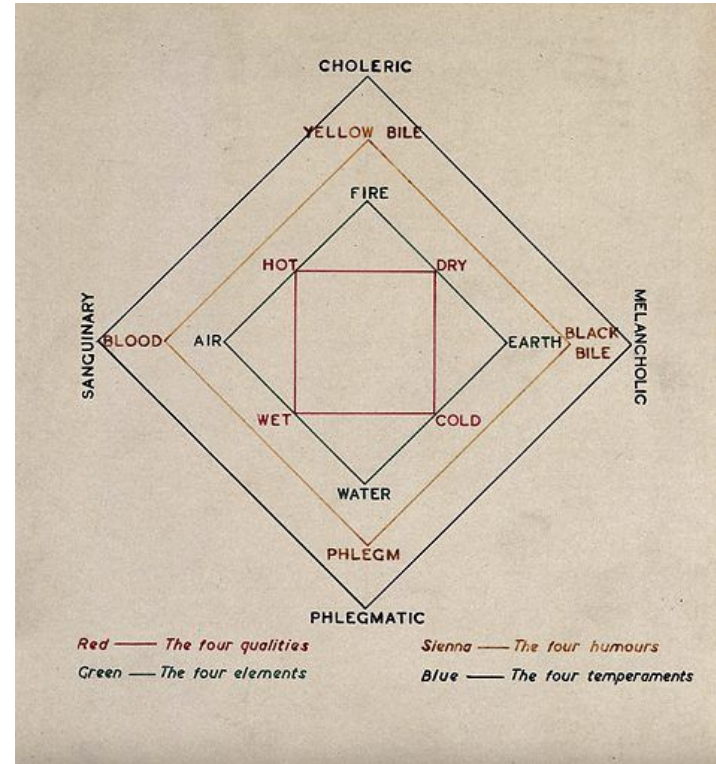
In the future, practising medicine without understanding human behaviour will be akin to basing clinical decisions on Galen.



Biases shape our decisions and those of our patients. Being aware of these biases is not enough, we need to design them out of our systems.



Data and experimentation are critical for this.





THE
**BEHAVIOURAL
INSIGHTS
TEAM**

Tēnā koe!

Get in touch:

alex.gyani@bi.team