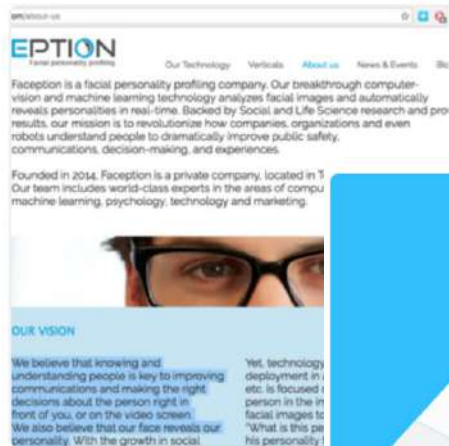




# Helping the public navigate research integrity

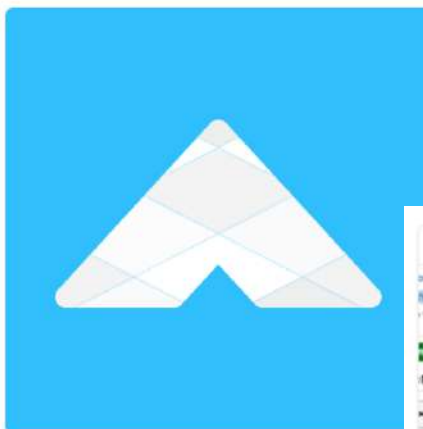
Tracey Brown

@senseaboutsci



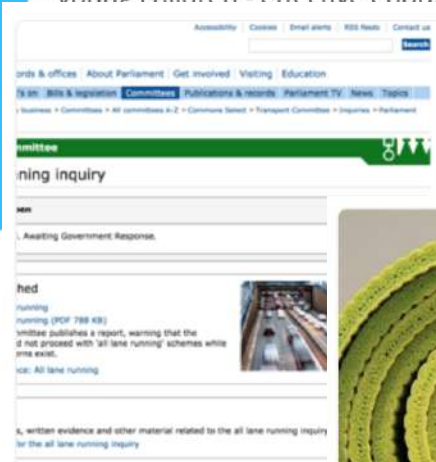
## Facial profiling reveals personality

Computer-vision and machine learning technology



## Do the claims of the expensive phonics programme Read Write Inc have any evidence?

The claim is that Read Write Inc Phonics is effective in teaching phonics to young children - effective enough to justify throwing out previous research-



## Is all-lane running a safe and effective solution to congestion on motorways?

All-lane running (opening the use of the hard shoulder as a permanent



## Yoga in schools improve mental health?

It was reported by The Telegraph that Edward Timpson said children should be taught yoga and meditation "to enable all children to enjoy good mental health and emotional wellbeing" <http://bit.ly/2c1INX3> [...]

View

Get help





# MAKING SENSE OF TESTING

Why scans and health  
tests for well people  
aren't always a good idea.



## HOW SHOULD YOU MAKE SENSE OF SCIENCE STORIES?

Every day we are bombarded with information about science from newspapers, radio and television programmes and the internet. Making sense of it all can be very difficult. What should be taken seriously? Which are 'sensational'? Sometimes scientists are reported as saying conflicting things. How do we know what to believe?

There is a system used by scientists to decide which research results should be published in a scientific journal. This system, called **peer review**, subjects scientific research papers to independent scrutiny by other qualified scientific experts (peers) before they are made public.

Peer review can help you make sense of science stories as it tells you that the research has passed the scrutiny of other scientists and is considered valid, significant and original.

Peer review means that statements made by scientists in scientific journals are critically different from other kinds of statements or claims, such as those made by politicians, newspaper columnists or campaign groups. Science is therefore more than just another opinion.

## A SHORT EXPLANATION OF PEER REVIEW

When a researcher, or team of researchers, finishes a stage of work, they usually write a paper presenting their methods, findings and conclusions. They then send the paper to a scientific journal to be considered for publication.

If the journal's editor thinks it is suitable for their journal they send the paper to other scientists who research and publish in the same field asking them to:

- Comment on its validity - are the research results credible?
- Judge the significance - is it an important finding?
- Determine its originality - are the results new?
- Does the paper refer properly to work done by others?
- Give an opinion as to whether the paper should be published, improved or rejected (usually to be submitted elsewhere).

This process is called peer review. The scientists (peers) assessing the papers are called referees or reviewers.

Scientists never draw firm conclusions from just one paper or set of results. They consider the contribution it makes in the context of other work and their own experience. It usually takes more than one research paper for results to be accepted as a valid conclusion.

## SUMMARY

- Science has a system for assessing the quality of research before it is published. This system is called **peer review**.
- Peer review means that other scientific experts in the field check research papers for **validity, significance and originality** - and for clarity.
- Editors of scientific journals draw on a large pool of suitable experts to scrutinise papers before deciding whether to publish and for clarity.
- Many of the research claims you read in newspapers and magazines, find on the internet, or hear on television and the radio are not published in a peer-reviewed journal.
- Some of this research may turn out to be good but much of it is flawed or incomplete. Many reported findings, such as claims about "wonder cures" and "new dangers", never come to anything.
- Unpublished research is no help to anyone. Scientists can't report or use it and as a society we can't base decisions about our public safety - or our family's health for example - on work that has a high chance of being flawed.
- So, no matter how exciting or compelling new scientific or medical research is, you must always ask...

**Is it peer reviewed? If not, why not?**

If it is peer reviewed, you can look for more information on what other scientists say about it, the size and approach of the study, whether it is part of a body of evidence pointing towards the conclusions.

# sense about science



# "I DON'T KNOW WHAT TO BELIEVE..."

## Making sense of science stories

This leaflet is for people who follow debates about science and medicine in the news. It explains how scientists present and judge research and how you can ask questions of the scientific information presented to you.

## SOURCES FOR FURTHER INFORMATION

**Sense About Science:** To find out more about poor review you can visit the Sense About Science website where there is a section dedicated to it. The section includes free articles, ideas (2004), electronic versions of the leaflet and additional educational resources. To request further copies of the leaflet please email: [ideas@senseaboutscience.org](mailto:ideas@senseaboutscience.org) or call: +44 (0) 20 7478 4360.

**Association of Medical Research Charities:** The AMRC has a page, for medical research, on the peer review of research grant applications: [amrc.org.uk/About/Aboutpeerreview.doc](http://amrc.org.uk/About/Aboutpeerreview.doc)

**Committee on Publication Ethics:** COPE provides a sounding board for journal editors dealing with how to deal with breaches in research and publication ethics: [publicationethics.org.uk](http://publicationethics.org.uk)

**National Electronic Library for Health:** The NELH has a 'Hitting the Headlines' archive, which at medical news stories and provides the research evidence on which they are based: [www.nelh.nhs.uk/hitv/archive.asp](http://www.nelh.nhs.uk/hitv/archive.asp)

**Science Media Centre:** The SMC has published a leaflet, Peer Review in a Nutshell, a guide for scientists preparing for a news interview: [sciencemedia.org/peer\\_review.htm](http://sciencemedia.org/peer_review.htm)

## ACKNOWLEDGEMENTS

This leaflet has been produced and distributed with sponsorship and help from:



Science is grateful for the input of the sponsors, the many organisations (in particular the Research UK, Asthma UK, Migraine Trust and Action Medical Research), the government officials, educational organisations, teachers, schools, libraries, pharmacies, pharmacists, scientists, and the public who have helped to make this leaflet possible.

## THE SCIENCE PUBLISHING SCENE

For scientific knowledge to progress scientists need to share their research findings with other scientists. The main way they do this is by publishing their research in scientific journals - periodical publications intended to further the development of science by reporting new research.

Journal editors receive many more papers than they can publish, so they use a two-step selection process. First, they consider whether the paper is a 'fit' for their journal. For example, some journals only publish research papers that are groundbreaking; others only publish research in a specific area, such as microbiology.

If a journal editor decides that a paper is right for their journal, they send it for peer review to check whether the research findings are valid, significant and original.

## A NOTE ON JOURNAL FUNDING AND AVAILABILITY

Most journals receive their income from subscriptions and some from organisational subsidies, conference organising and advertising.

Many are available on the internet and, increasingly, make their online content free after a certain period, usually one year.

There are alternative journal funding models, such as scientists paying the costs of reviewing and publishing their articles so that they can be made freely available. Less than 1% of papers are published this way.

## Did you know?

There are around 21,000 scholarly and scientific journals that use the peer-review system. A high proportion of these are scientific, technical or medical journals, publishing over 1 million research papers each year.



**ALL TRIALS REGISTERED**

Sign the petition



Tell me more

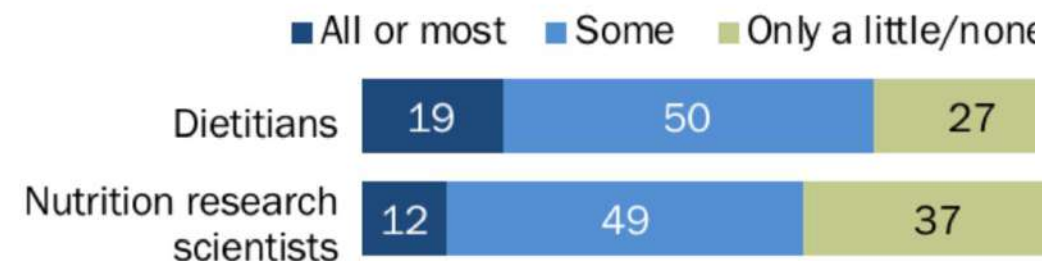
**ALL RESULTS REPORTED**



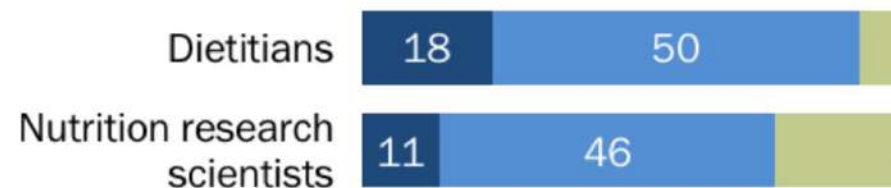
# Few Americans say nutrition scientists are transparent about potential conflicts of interest all or most of time

% of U.S. adults who say dietitians/nutrition research scientists do each of the following \_\_\_\_ of the time

Are transparent about potential conflicts of interest with industry groups



Admit mistakes and take responsibility for them

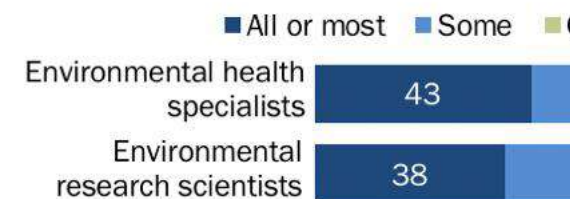


Note: Respondents who did not give an answer are not shown.  
Source: Survey conducted Jan 7-21, 2019.  
"Trust and Mistrust in Americans' Views of Scientific Experts"

# About four-in-ten say environmental researchers care about the public's best interests all or most of the time

% of U.S. adults who say environmental health specialists/environmental research scientists do each of the following \_\_\_\_ of the time

Care about the best interests of the people in the community/the public



# Many are skeptical that environmental scientists usually admit their mistakes

% of U.S. adults who say environmental health specialists/environmental research scientists do each of the following \_\_\_\_ of the time

Are transparent about potential conflicts of interest with industry groups



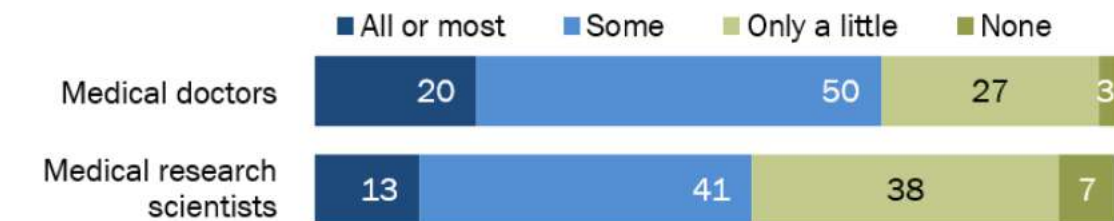
Admit mistakes and take responsibility for them



an answer are not shown.  
2019.  
ws of Scientific Experts"

# Few believe medical professionals regularly face serious consequences for misconduct

% of U.S. adults who say medical research scientists/medical research scientists who engage in misconduct face serious consequences \_\_\_\_ of the time



Cynicism  $\neq$  research integrity



Cynicism

research integrity





## Socialise research integrity

- Talk about research well done
- Include the architecture

## Challenge cynicism

- Talk about limits
- Equip the questions



## Cabinet Office

	Diagnosis	Proposal	Implementation	Testing & Evaluation
Establishing a Public Service Ombudsman	2	2	2	1
Civil Service apprenticeships	2	1	1	3
Combating electoral fraud	1	1	1	1
Reforming anonymous electoral registration	1	1	1	0
Strengthening cyber security skills	1	0	0	1
Votes for British citizens overseas	0	1	1	0

## Department for Business, Energy & Industrial Strategy

	Diagnosis	Proposal	Implementation	Testing & Evaluation
Furniture and furnishings fire safety regulations	2	3	3	2
Ending unabated coal generation	2	3	2	2
Reforming the Employment Tribunal system	2	3	2	2
Raising domestic boiler standards	2	3	2	1
Executive pay reform	2	2	2	2
Climate Change Agreement (CCA) target buy-out price changes	3	2	1	1
Creating new Institutes of Technology	2	1	n/a	n/a
Overseas-owned UK property register	2	1	1	0

## Department for Communities & Local Government

	Diagnosis	Proposal	Implementation	Testing & Evaluation
Ban on letting agent fees	2	2	2	2
New funding model for supported housing	3	1	1	2
Supporting enterprise and innovation in the Midlands	2	2	2	0
Supporting Affordable Private Rent housing	2	2	1	1
Use of public parks for running	1	2	2	0
Local government finance settlement	n/a	1	2	1
Modifying the neighbourhood planning process	1	1	1	1
Homelessness prevention programme	0	0	0	1

## Department for Digital, Culture, Media & Sport








	Diagnosis	Proposal	Implementation	Testing & Evaluation
Design of the broadband Universal Service Obligation	2	3	3	1
Creating a national 5G Innovation Network	2	2	2	2
Deregulation of commercial radio	3	2	1	1
Prohibiting third party betting on non-UK EuroMillions	2	2	2	1
Increasing the regional impact of Channel 4	1	2	2	1
Regulatory changes to boost tourism businesses	1	0	0	1
Digital skills training	1	1	0	0
Public Services Incubator for small charities	0	0	0	0

## Department for Education

	Diagnosis	Proposal	Implementation	Testing & Evaluation
Supporting selective schools	3	2	1	1
Early years national funding formula	2	2	1	1
New funding model for apprenticeships	2	1	2	1
Postgraduate doctoral loans	2	1	1	1
Schools national funding formula	2	1	1	1
Inclusive assessment for primary school pupils	1	2	1	1
Establishing Social Work England	1	1	1	0
Modern foreign languages A and AS level content	0	0	0	0

## Department for Environment, Food & Rural Affairs

	Diagnosis	Proposal	Implementation	Testing & Evaluation
Fixed penalties for environmental offences	3	3	2	2
Ban on landing egg-bearing lobsters and crawfish	3	2	2	2
Tackling roadside NO <sub>2</sub> concentrations	3	2	2	1
Packaging waste recycling targets	1	3	3	0
Ban on microbeads	2	2	2	1
Bovine TB testing in high-risk areas	1	2	1	1
Horse identification	1	1	1	1
Flexibility for fisheries management	1	1	0	1

Sponsor name	 Trials on EUCTR 	 Trials due to report results 	 % Reported 	 Trials with inconsistent data
Novartis	1446	767	100.0%	383
GlaxoSmithKline	1149	506	100.0%	494
Merck Sharp & Dohme (MSD)	791	437	100.0%	174
Bayer	322	207	100.0%	57
Boehringer Ingelheim	378	150	100.0%	156
Novo Nordisk	251	98	100.0%	98
<b>King's College London</b>	107	69	100.0%	3
Servier Laboratories	144	66	100.0%	51
Novartis Vaccines	132	56	100.0%	67
Chiesi Farmaceutici S.p.A	108	54	100.0%	32
Manchester University NHS Foundation Trust	63	53	100.0%	0
University of Birmingham	117	52	100.0%	4
Astellas	152	46	100.0%	75

# New clean energy is closer than you think

Climate change means that there's never been a more important time to understand the natural environment.

In the UK, a network of observatories is being established to deliver essential new data from underground. The scientific data can help us to understand how geothermal energy, hydrogen, carbon capture and storage, and storage solutions for wind, solar and tidal energy can reduce our carbon emissions.

Each observatory in Cheshire, Glasgow and elsewhere delivers a different body of knowledge. The UK Geoenergy Observatories will inform how geoenergy can help to deliver clean economic growth.

Publicly run, owned and funded, each observatory will contribute to world-class science that puts the UK at the forefront of delivering clean energy at the scale required to achieve net zero by 2050.

[Access data](#)
[Learn more](#)


## Glasgow Observatory

In Glasgow and Rutherglen, we will be observing flooded mine workings beneath the east end of the city.

## Talking about geoenergy

Hazel Napier  
January 29, 2021



The

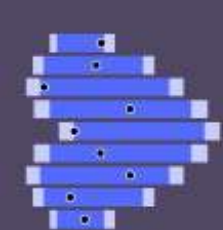
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102

2947

>1600



[Home](#)[? What, why, how?](#)[Explore the data](#)[Everything else](#)

# UNDERSTANDING CHILDREN'S HEART SURGERY OUTCOMES

This site is to help people make sense of published survival data about children's heart surgery in the UK and Ireland.

Our website will help you:

- understand how the NHS monitors children's heart surgery
- explore what survival rates can and can't tell you
- explore published data for hospitals in the UK and Ireland



What, why, how?

**What** do we mean by survival rates?

**Why** are survival rates after children's heart surgery hard to interpret?

**How** does the NHS monitor them?



Explore the data

**Explore published survival statistics by:**

browsing hospitals individually;

viewing a one page summary of all hospitals;



Everything else

What happens if the data raises concerns?

More detail about how survival statistics are monitored, including an explanatory video.

Limitations of this data



# Talk

Advanced search

[Active](#) | [I'm on](#) | [I'm watching](#) | [I started](#) | [Last 15 minutes](#) | [Last hour](#) | [Last Day](#)

## Guest post: "I hope we've helped others preparing for their child's heart surgery"

Alex Smith says the lack of clear information added to her stress when her daughter was diagnosed with a heart defect - so she got involved with a project to improve resources



Alex Smith

Posted on: Tue 02-Aug-16

11:08:26

(3 comments)

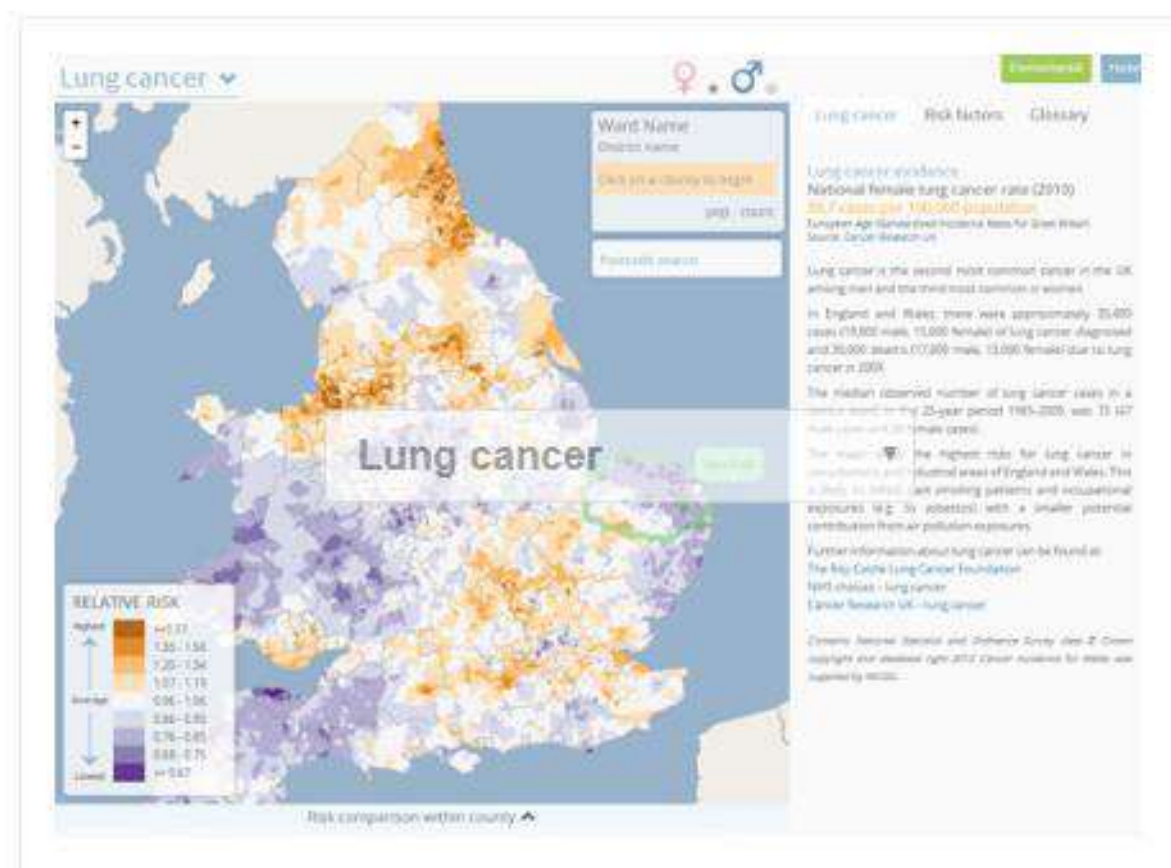
"As a parent, I need clear, straightforward information, even when I might be in a state of panic or distress."



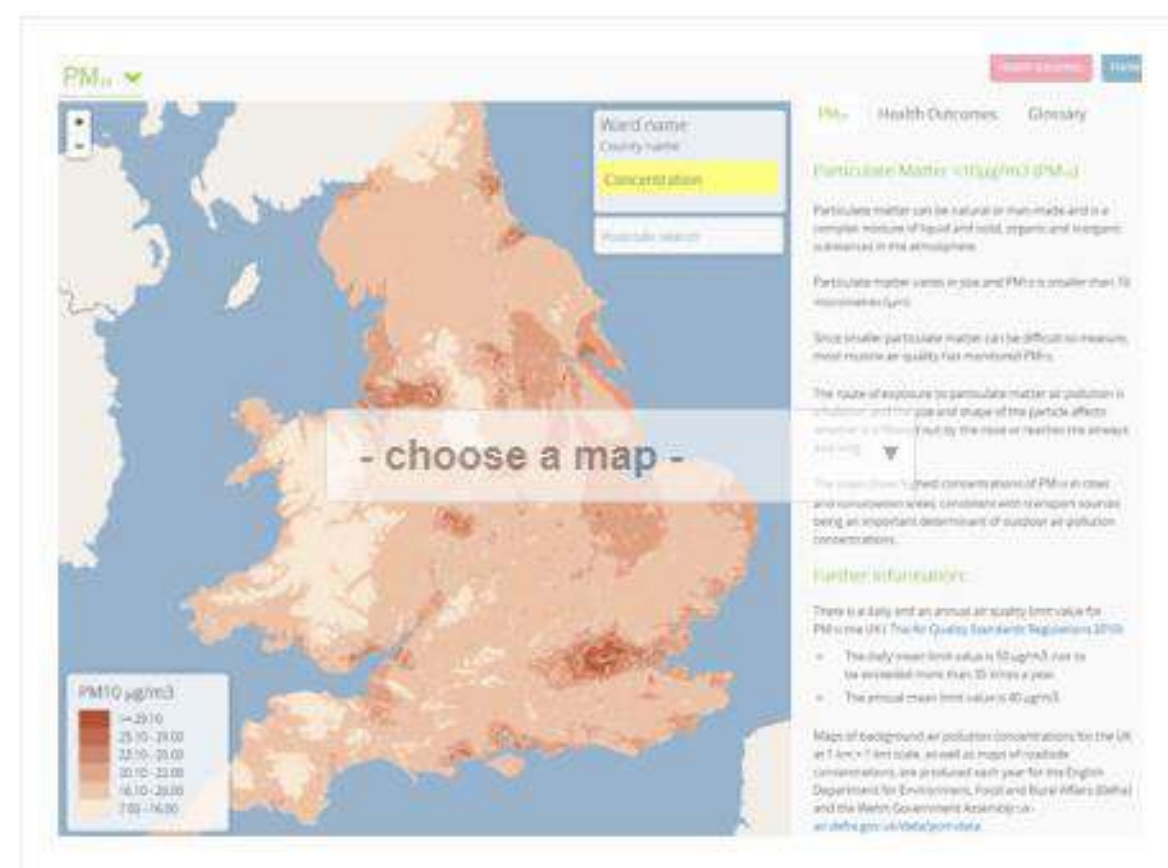


Hover over the screenshots to see a list of the available maps.

## Health conditions



## Environmental agents



# Understanding uncertainty

## Unsettled

The origin of  
consciousness

The weather forecast  
for 3 months from now

The weather forecast  
for 3 days from now

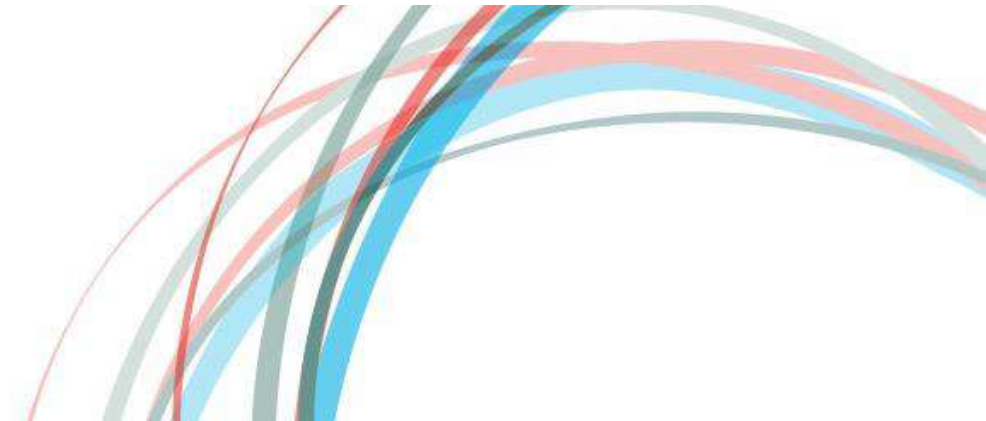
## Settled

Newton's law of  
gravity

Most nutritional science

The existence of  
gravitational waves

The appearance of  
dinosaurs





# ENGAGING WITH UNCERTAINTY

- It doesn't mean we know nothing
- It doesn't mean that anything could be true
- Confidence in new evidence often compares favourably with confidence in previous
- Operational knowledge, not complete knowledge, is the goal. Incomplete information can be enough: *Newtonian physics explained far less of the universe than Einstein but they were enough to put a man on the moon.*
- The essential question is not 'are you certain?' but 'are you sure you'll absorb new information and adjust?'

**Public confidence is not enhanced by over confident statements**

**ASK FOR  
EVIDENCE** 

ASKFOREVIDENCE.ORG







# DATA SCIENCE: A GUIDE FOR SOCIETY

## DATA SCIENCE: A GUIDE FOR SOCIETY

We must not let data science become a mysterious “black box” where questions about evidence quality drop away. When you see a claim being made from data science derived evidence, here are the three questions to ask.

### 1. Where does it come from?

It's useful to find out...

- o The original question asked
- o The data collection method
- o The reliability of the source
- o The limitations of the data sample
- o How representative the data is
- o The relationship type, eg. correlation vs causation
- o Whether the relationships are real or flukes

### 2. What assumptions are being made?

Important assumptions to challenge are...

- o That the right thing has been measured
- o That all variables missing from the model are irrelevant
- o That the results can be generalized to other times, places or groups.
- o That using algorithms eliminates human prejudice

### 3. Can it bear the weight being put on it?

- o They should be able to explain...
- o How well the model performs
- o Whether the model has been tested correctly.
- o Whether it's worth using in the real world
- o How precise these predictions are

## THE STAGES OF DATA SCIENCE

Let's take a question and see how data science is being used to answer it.

Some local governments might seek to use data science to see if people at risk of becoming homeless could be identified and offered help before things got to that point. To do this, they ask a data scientist to create a way of categorizing citizens into two categories: at risk, or not at risk.

### Data collection

Data scientists gather existing data from a variety of sources that they think are relevant to the question they are asking.

They gather data on citizens from last year, variables such as income, age, debt level, employment history or use of government assistance. This data would be collected for all citizens being studied, along with whether they became homeless in that year or not.



### Data preparation and cleaning

This involves getting the data ready for analysis and arranged into the right format.

Errors in the format of address would be corrected, missing data dealt with where possible, and all the data converted into one type of format.



Street Address	Zip Code
123 Main St	10001
456 Elm St	10002
789 Oak St	10003
101 Pine St	10004
202 Cedar St	10005

### Using algorithms on the data to create a model

Algorithms are used to estimate the relationships between the variables by learning from the data. This information is used to create a model.

An algorithm would work out how the different variables affected someone's risk of becoming homeless. For example, if sets of homeless citizens had an income below \$25,000 before becoming homeless, the algorithm would flag this as a risk factor. All this information is used to create a model, which is an equation that links these variables together to predict if someone is at risk or not.

Income	< \$25,000
> 5 months unemployment	
> 5 months defaulted debt	
At risk of homelessness	

### Testing the model

Some of the data collected at the start is held back and not used to create the model. Instead, this “test dataset” is used to test how good the model is at predicting things.

Using this test data, we can see how good the model is at predicting which citizens were at risk of becoming homeless.



### Deploying the model

Data scientists will communicate the findings and performance of the model to decision makers, often using visualization techniques, such as graphs or charts. The decision makers may then choose to use the model in real life.

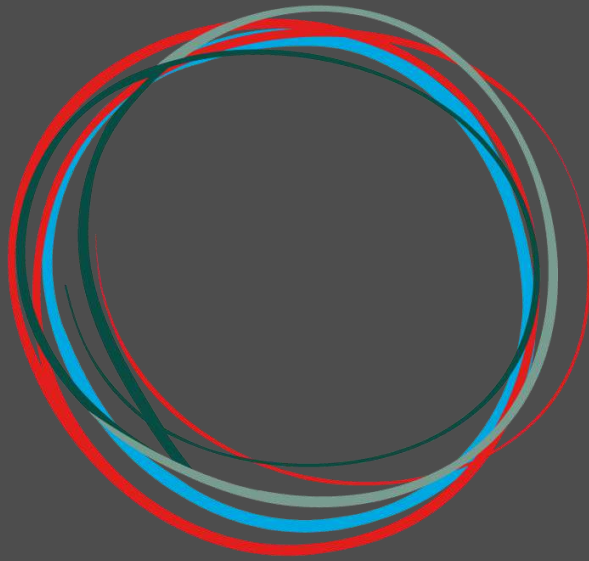
A local official may decide, after hearing from the data scientist, that the model was good enough at categorizing people to trial an intervention program to offer help to citizens flagged as ‘at risk’.





Ask the  
question

Anticipate  
the question



# SENSE about SCIENCE

Because evidence matters