What can data scientists learn from data-driven responses to Covid-19?

Matthew Higgs MMath, Phd
Observatory for Monitoring Data Driven Approaches to Covid-19

Matthew Higgs MMath, PhD is a Lecturer in the Department of Computing and Information Sciences at Northumbria University and a Co-Investigator on the UKRI-funded project ‘Observatory for Monitoring Data-Driven Approaches to Covid-19’ (omddac.org.uk). Since completing his PhD in Computational Statistics and Machine Learning at University College London in 2011, Matthew has worked in technical and non-technical roles in academia, the commercial sector, and the public sector - with a focus on managing diverse stakeholders and developing data-driven products and solutions.

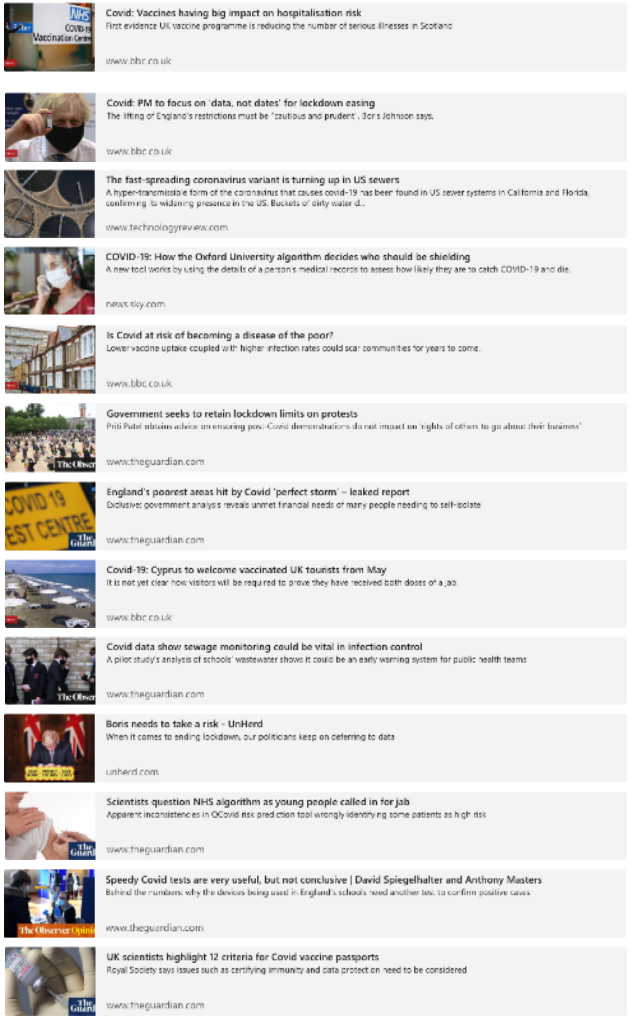
What is the impact of data science?
Does it do more good than harm?
What is the best advice to give?

UCL · University of Glasgow · The Data Lab (value from data) · STREAMBA · Northumbria University Newcastle · University of Bristol

Contents

- Project Overview
- Success(?) Stories
- Bridging the Gap

Disclaimer… very thin slice and WIP



Project Overview

Observatory for Monitoring Data Driven Approaches to Covid-19

MDDAC

- People
- Stage
- Initial Results

MDDAC

Centre for Data Ethics and Innovation

Ada Lovelace Institute

medConfidential
KEEP OUR SECRETS

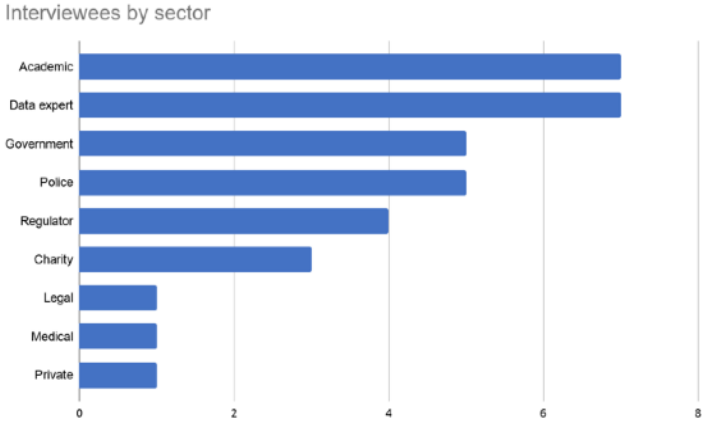
Northumbria University NEWCASTLE

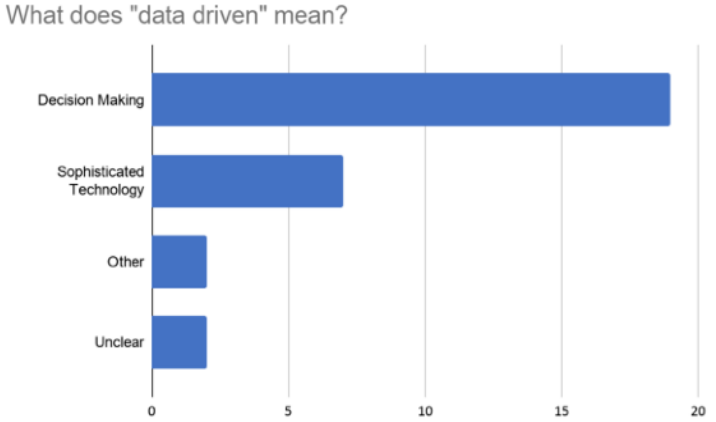
RUSI
www.rusi.org

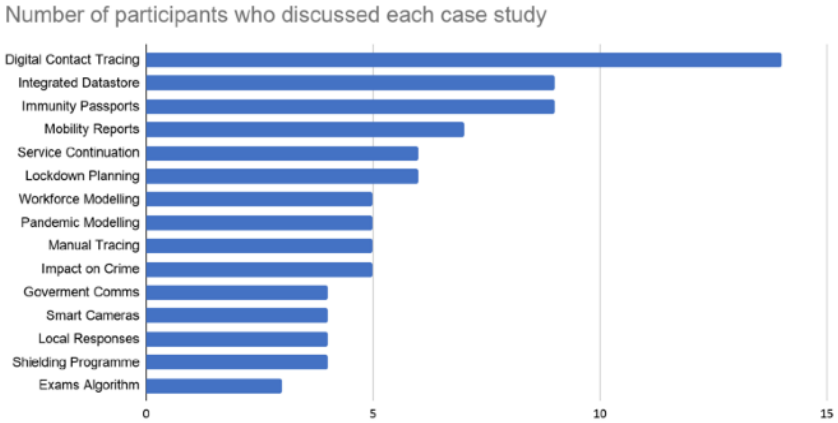
UKRI Arts and Humanities Research Council

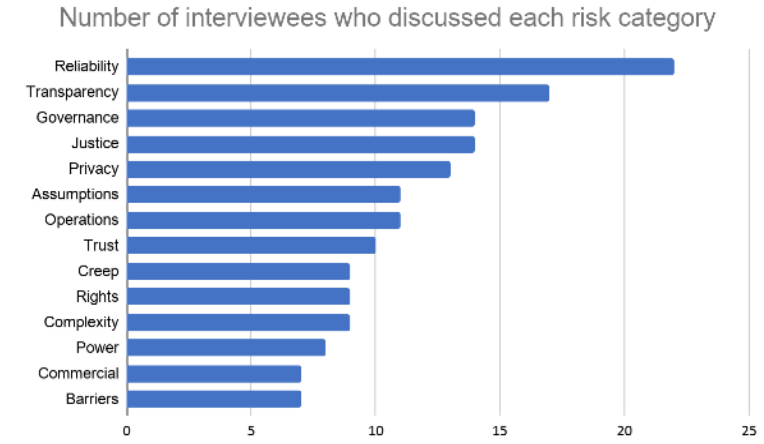
Activity	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct
Stakeholder Mapping												
Case Study Review												
Public Survey												
Research Compendium												
Practitioner Guidelines												
Dissemination												

MDDAC


Interviewees by sector
Academic
Data expert
Government
Police
Regulator
Charity
Legal
Medical
Private
0
2
4
6
8


What does "data driven" mean?
Decision Making
Sophisticated Technology
Other
Unclear
0
5
10
15
20


Number of participants who discussed each case study
Digital Contact Tracing
Integrated Datastore
Immunity Passports
Mobility Reports
Service Continuation
Lockdown Planning
Workforce Modelling
Pandemic Modelling
Manual Tracing
Impact on Crime
Goverment Comms
Smart Cameras
Local Responses
Shielding Programme
Exams Algorithm
0
5
10
15


Number of interviewees who discussed each risk category
Reliability
Transparency
Governance
Justice
Privacy
Assumptions
Operations
Trust
Creep
Rights
Complexity
Power
Commercial
Barriers
0
5
10
15
20
25

https://www.omddac.org.uk/news/mapping-the-data-driven-landscape/

Mapping the Data-Driven Landscape

Posted on 25 January 2021 by Rachel Allsopp

Initial Insights Report

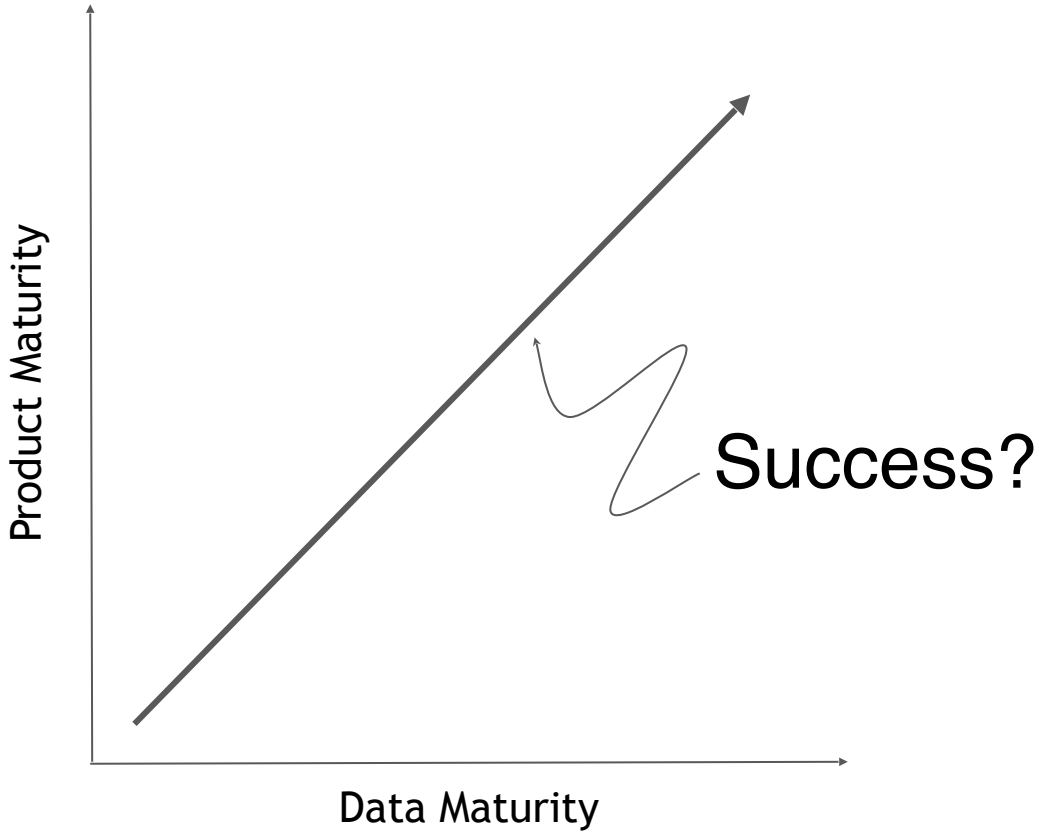
Key findings

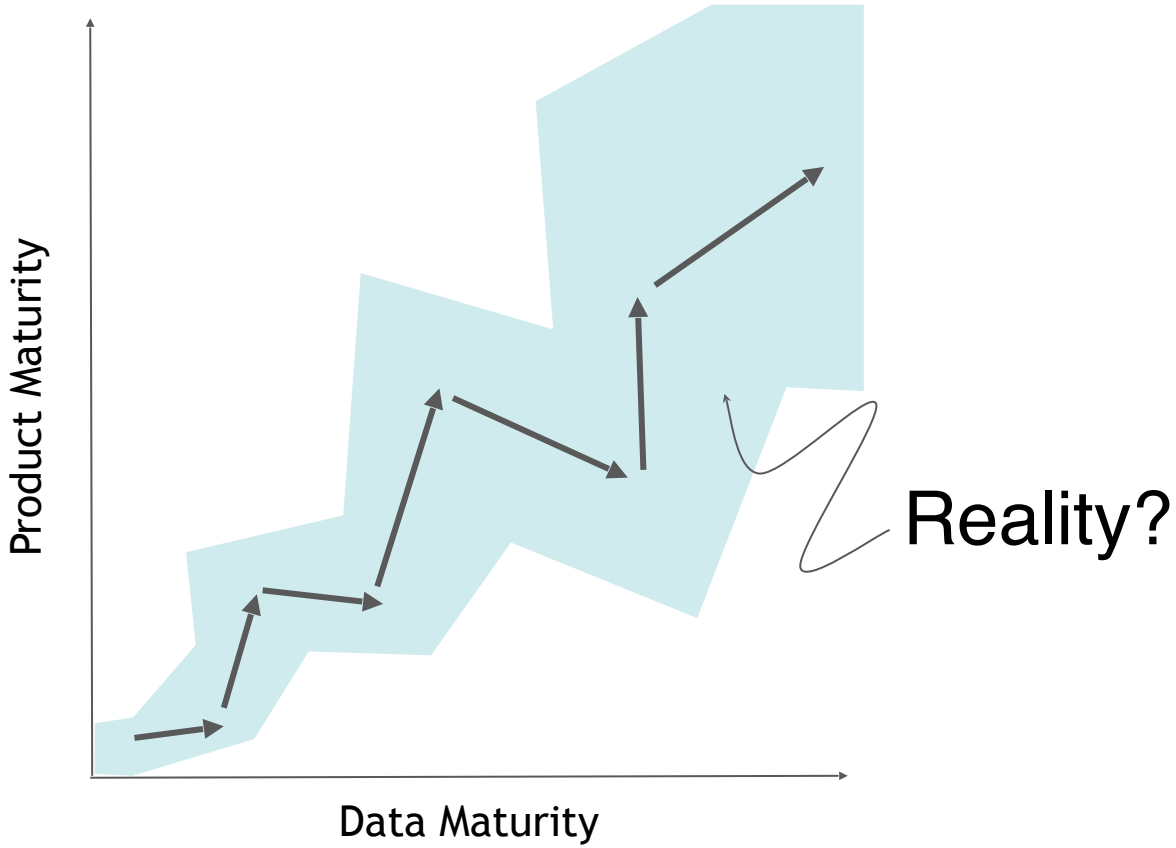
- Data-driven approaches to the Covid-19 pandemic exist on a spectrum between entirely automated, AI-powered processing and the more 'mundane' uses of digital information and statistics with a 'human in the loop';
- A number of wide-ranging benefits have been observed, including: supporting the continuation of offering services remotely during the pandemic, and providing the ability to 'find simple pictures out of mind-bending data' therefore gaining insights which may not otherwise have been possible;
- At the same time, there are significant risks which lie not only in the use of novel, automated – and in many cases, untested – technologies, but in the underlying data itself, in terms of its quality, robustness and embedded assumptions. Greater transparency is needed regarding these shortcomings in order to ensure the maintenance of public trust.

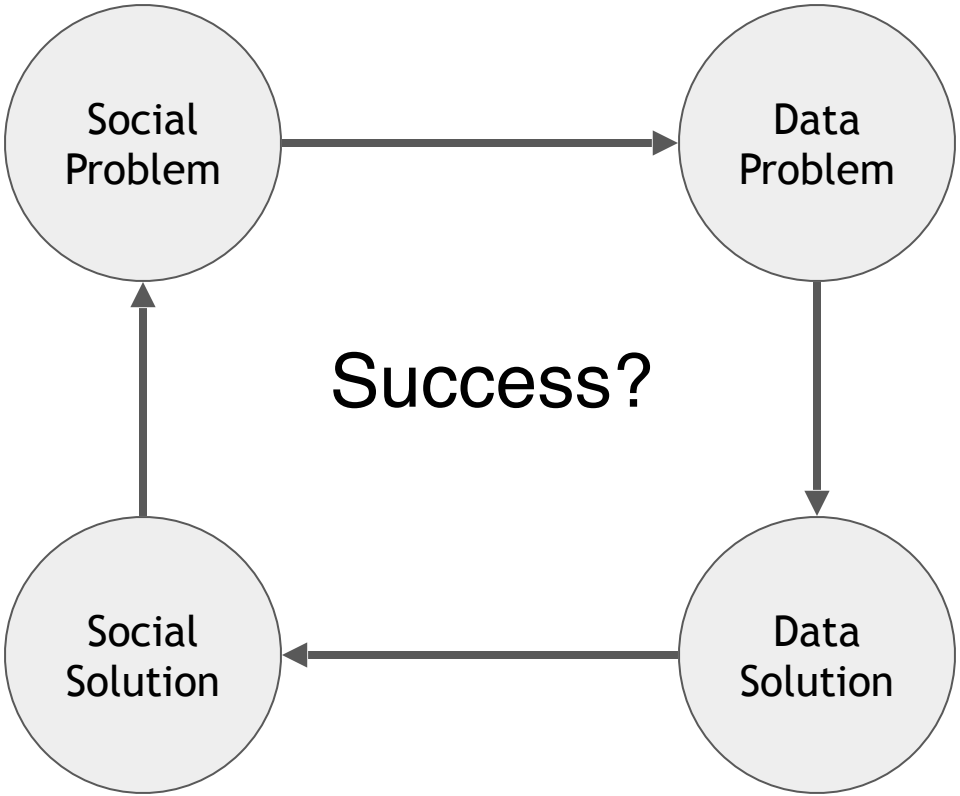
Success(?) Stories

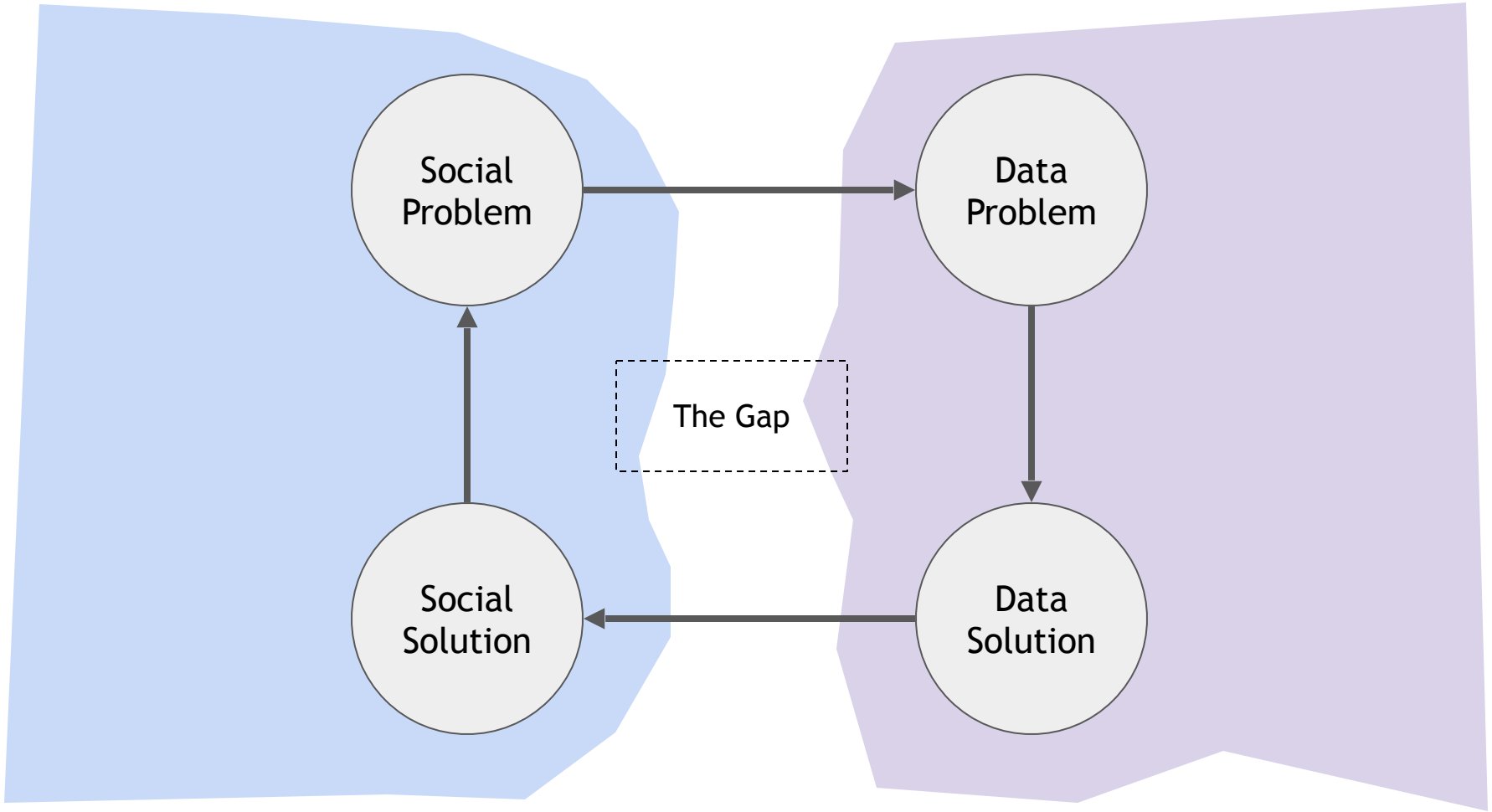
- What is success?
- Contact Tracing
- The Vaccine(s)

What is success?


Product Maturity
Data Maturity
Success?

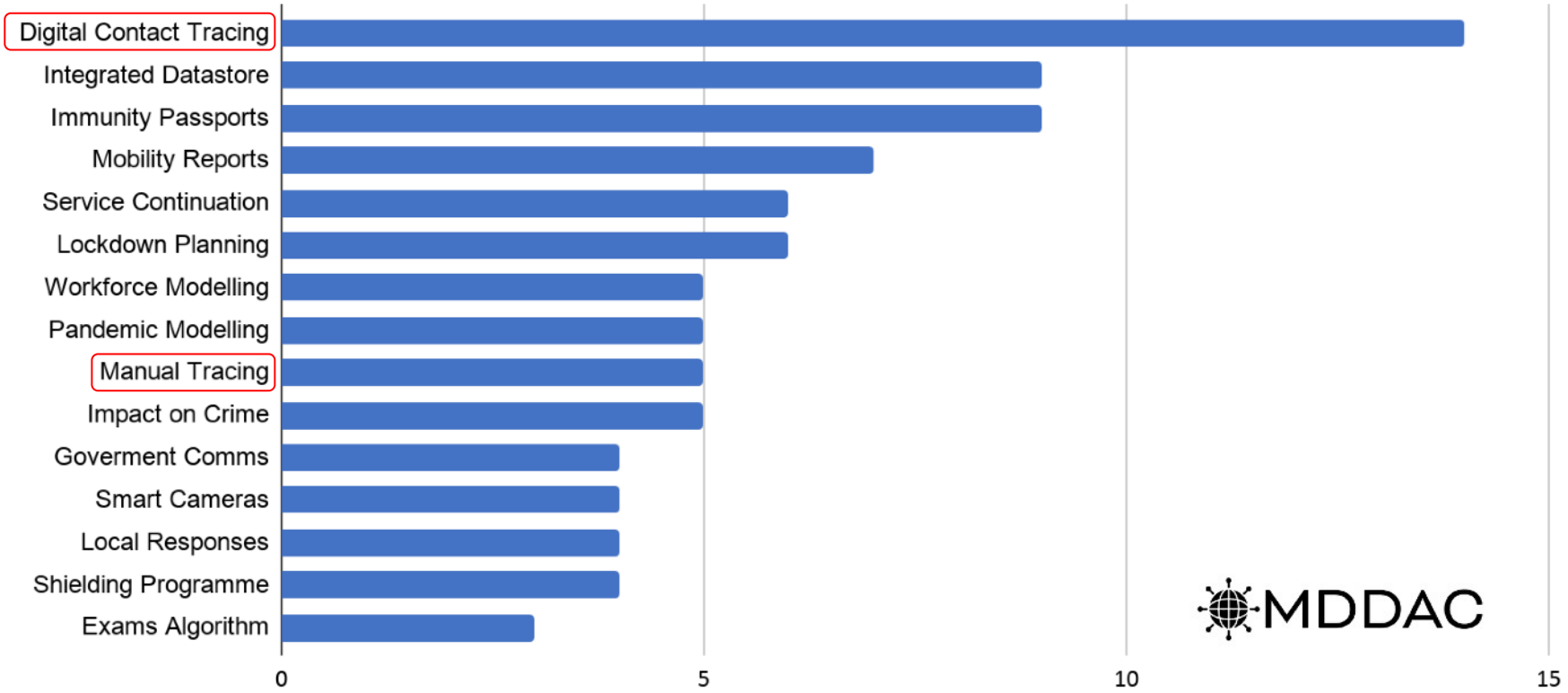

Product Maturity
Data Maturity
Reality?

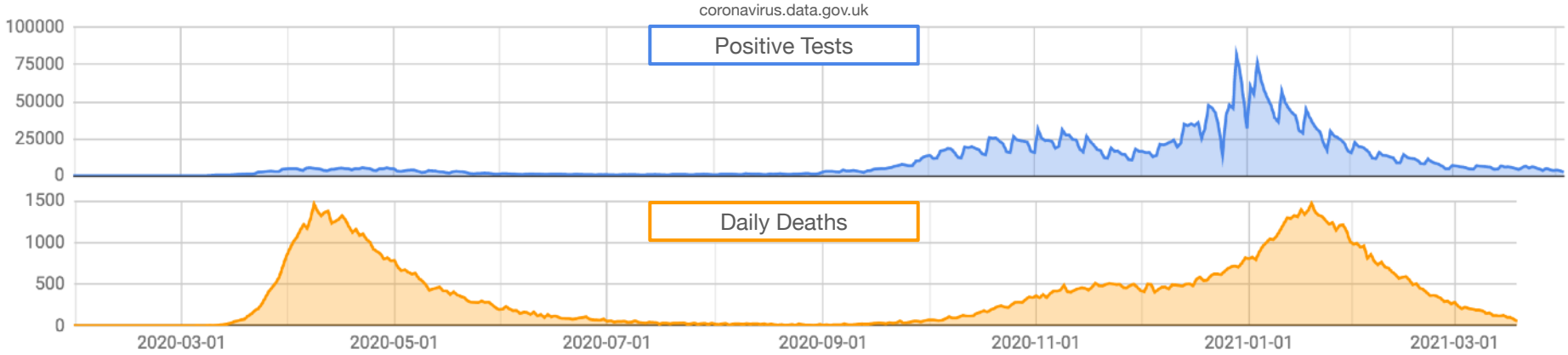

Social Problem
Data Problem
Success?
Social Solution
Data Solution


Social Problem
Data Problem
The Gap
Social Solution
Data Solution

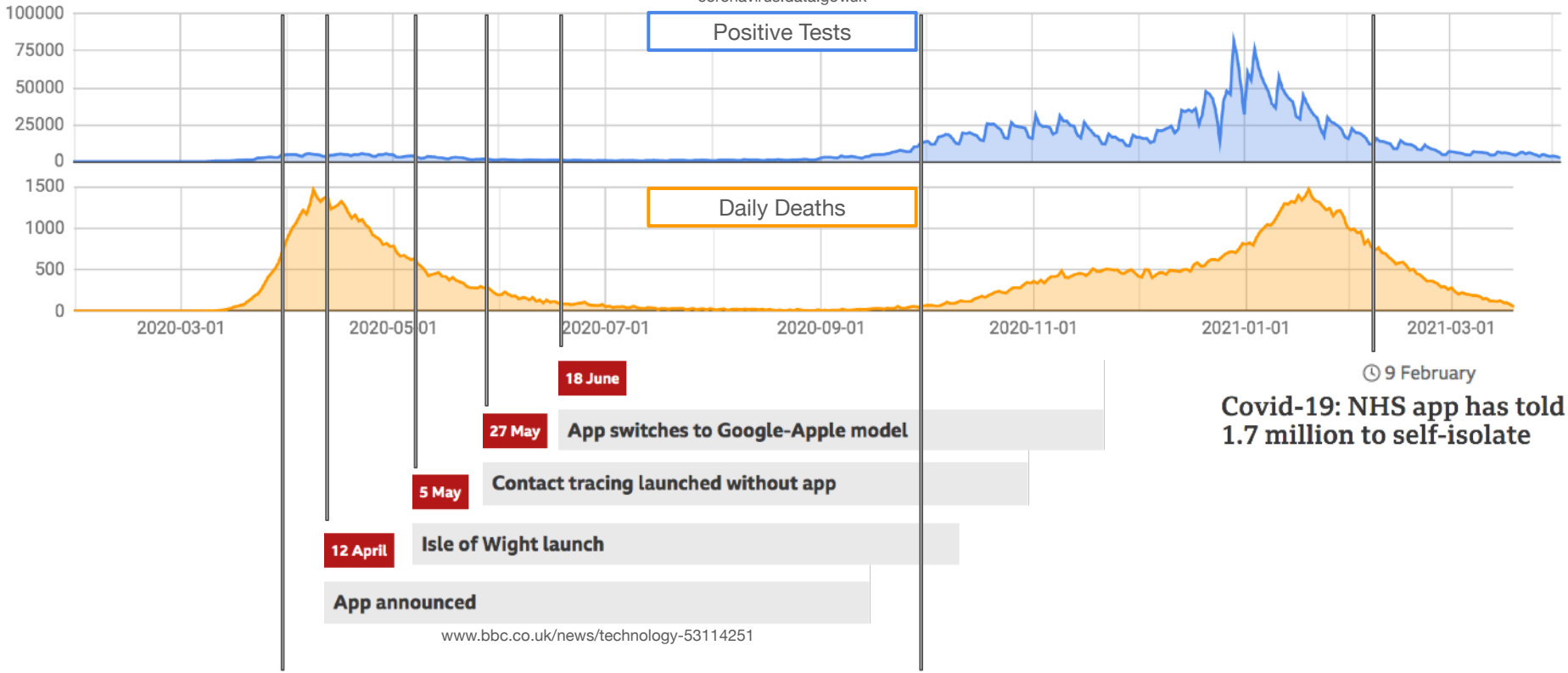
Contact Tracing

Number of participants who discussed each case study




coronavirus.data.gov.uk
Positive Tests
100000
75000
50000
25000
0
Daily Deaths
1500
1000
500
0
2020-03-01
2020-05-01
2020-07-01
2020-09-01
2020-11-01
2021-01-01
2021-03-01

coronavirus.data.gov.uk



18 June
27 May App switches to Google-Apple model
5 May Contact tracing launched without app
12 April Isle of Wight launch
App announced

www.bbc.co.uk/news/technology-53114251

9 February

Covid-19: NHS app has told 1.7 million to self-isolate

March 31, 2020.

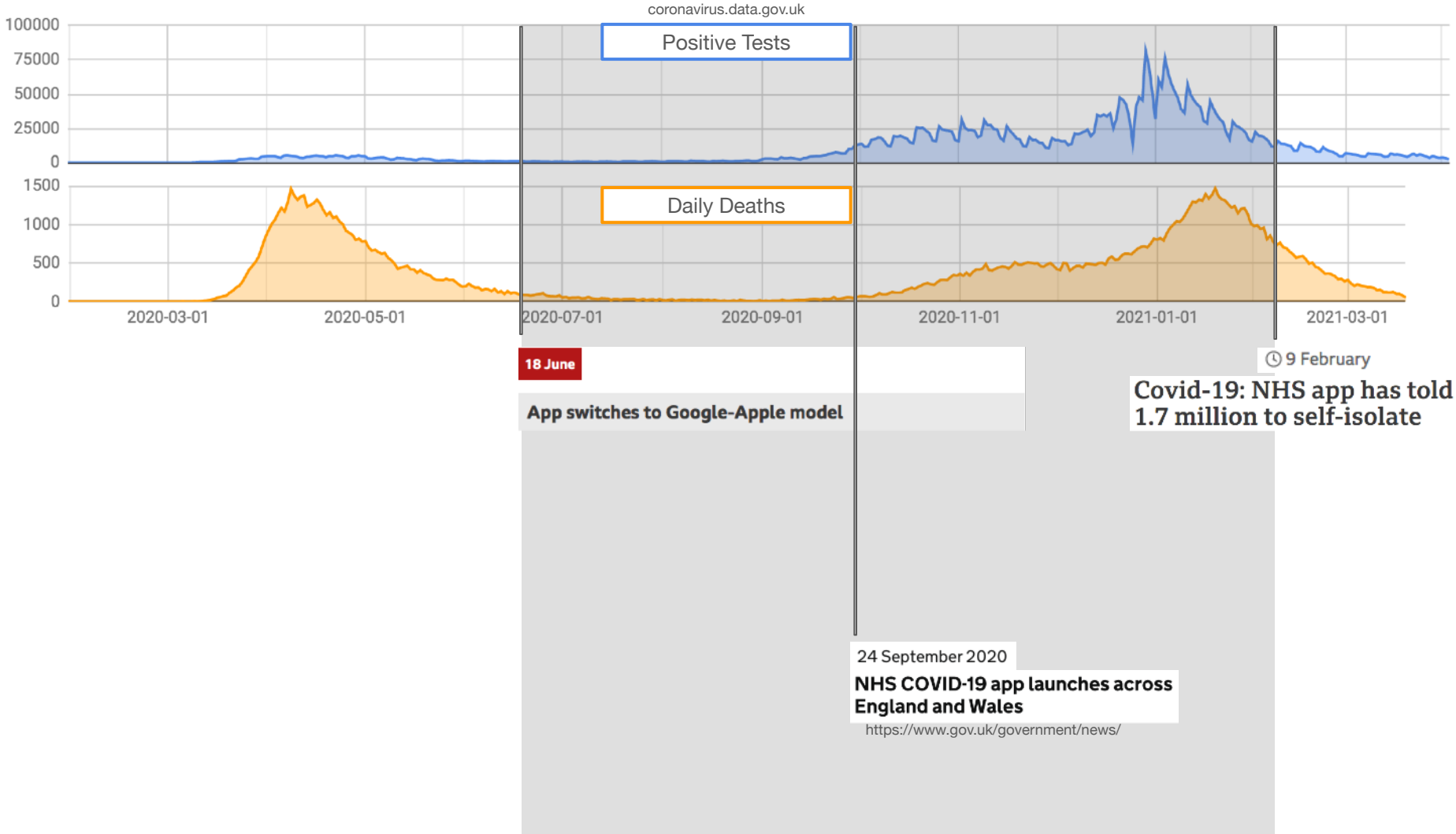
Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing

https://www.medrxiv.org/content/10.1101/2020.03.08.20032946v2

24 September 2020

NHS COVID-19 app launches across England and Wales

https://www.gov.uk/government/news/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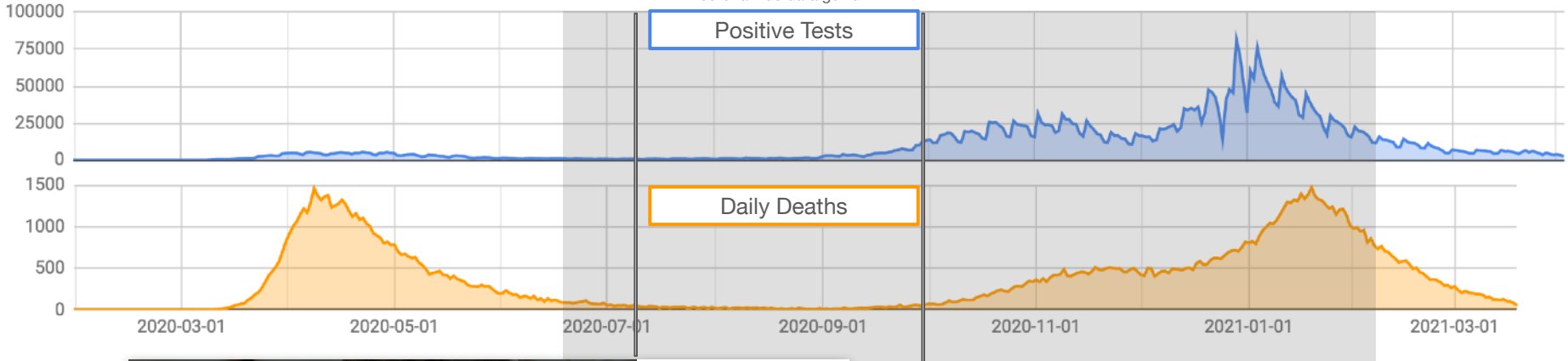
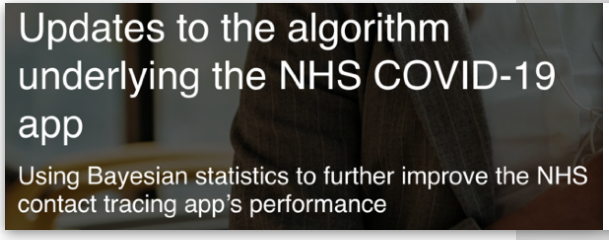




Professor Mark Briers
Programme Director for Defence and Security and Co-Chair of the Research and Innovation Advisory Committee

Inferring proximity from Bluetooth Low Energy RSSI with Unscented Kalman Smoothers

Tom Lovett[1], Mark Briers[1,*], Marcos Charalambides[1], Radka Jersakova[1], James Lomax[1], and Chris Holmes[1,2]

[1]The Alan Turing Institute, London, U.K.
[2]University of Oxford, Oxford, U.K.
*Corresponding author: Mark Briers, mbriers@turing.ac.uk

July 13, 2020

nihp-public / **covid-19-app-ios-ag-public**

COVID19 iOS App

NHS COVID-19 AG

An app using Apple's `ExposureNotification` API to detect contacts with other users of the app that may have had COVID-19.

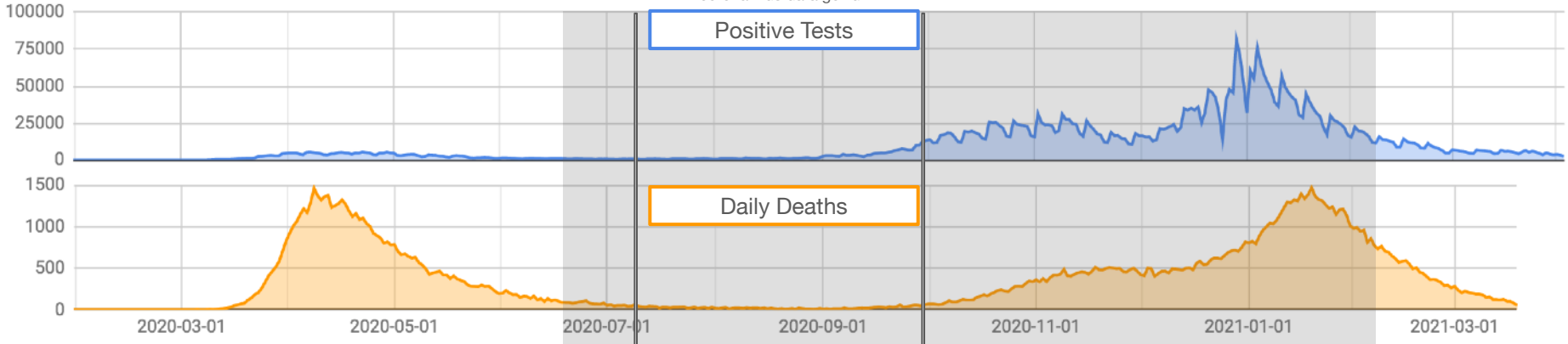
24 September 2020

NHS COVID-19 app launches across England and Wales

https://www.gov.uk/government/news/

Development

coronavirus.data.gov.uk



Evaluation

Updates to the algorithm underlying the NHS COVID-19 app

Using Bayesian statistics to further improve the NHS contact tracing app's performance

Professor Mark Briers
Programme Director for Defence and Security and Co-Chair of the Research and Innovation Advisory Committee

Demonstrating the impact of the NHS COVID-19 app

Statistical analysis from researchers supporting the development of the NHS COVID-19 app

Professor Mark Briers
Programme Director for Defence and Security and Co-Chair of the Research and Innovation Advisory Committee

Professor Chris Holmes
Programme Director for Health and Medical Sciences, and Turing Fellow

Christophe Fraser
Senior Group Leader in Pathogen Dynamics, Big Data Institute at University of Oxford

The epidemiological impact of the NHS COVID-19 App

Development

Inferring proximity from Bluetooth Low Energy RSSI with Unscented Kalman Smoothers

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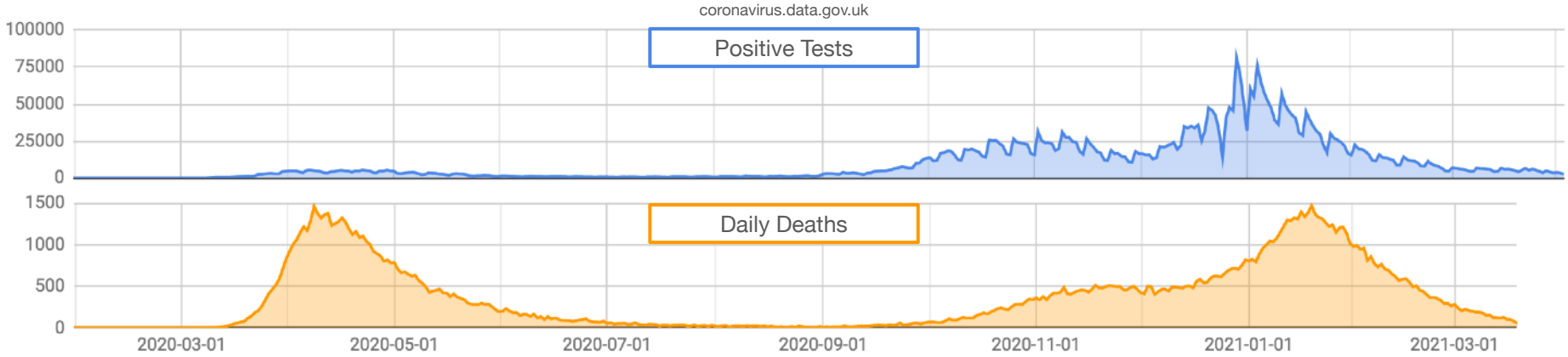
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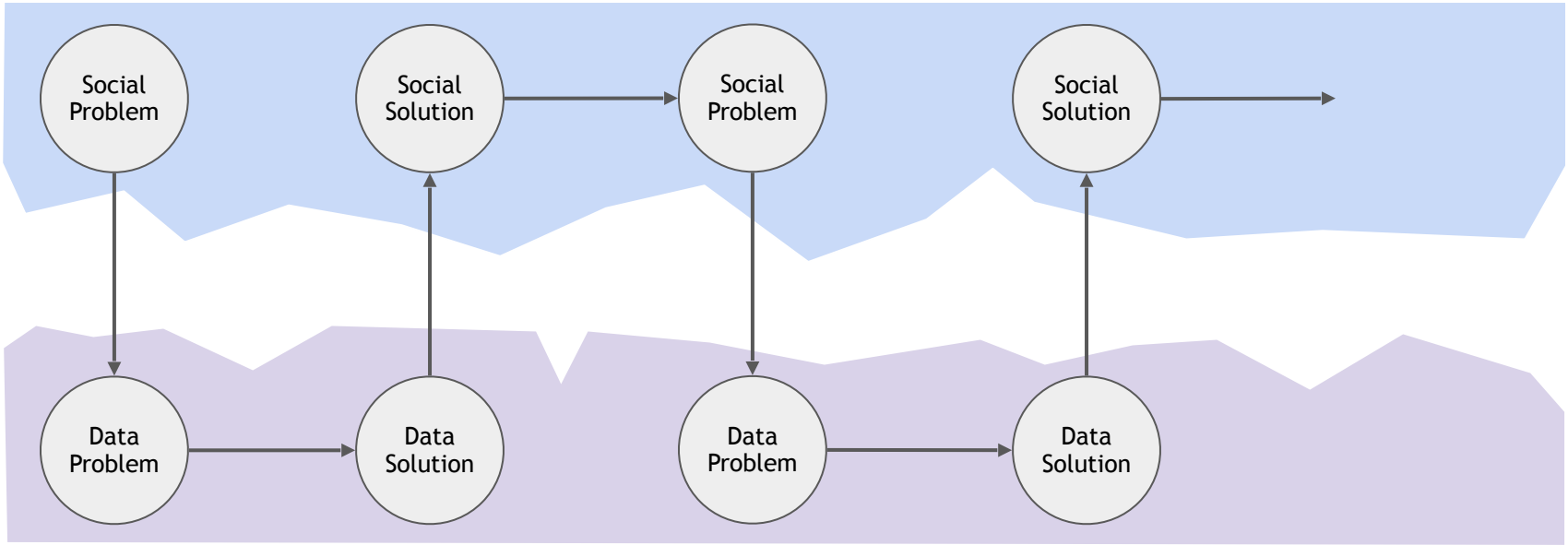
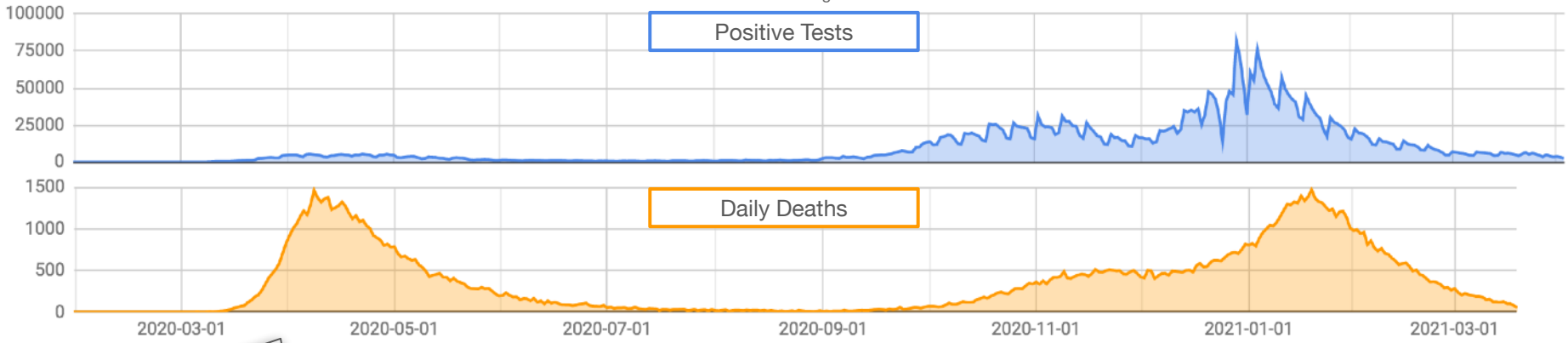

Social Problem
Social Solution
Social Problem
Social Solution
Data Problem
Data Solution
Data Problem
Data Solution

coronavirus.data.gov.uk



Contain epidemic without need for mass quarantines

Launch manual contact tracing

Automatic process to import CSV into Excel template

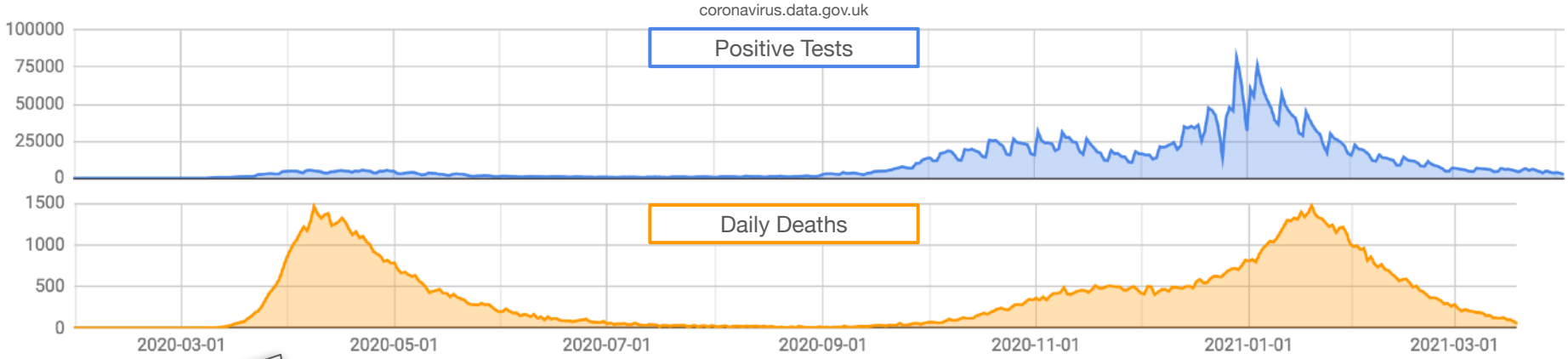
15,841 unreported cases, missed due to “IT error”

House of Commons
Public Accounts Committee

COVID-19: Test, track and trace (part 1)

committees.parliament.uk/publications/4976/documents/50058/default/

www.bbc.co.uk/news/technology-54423988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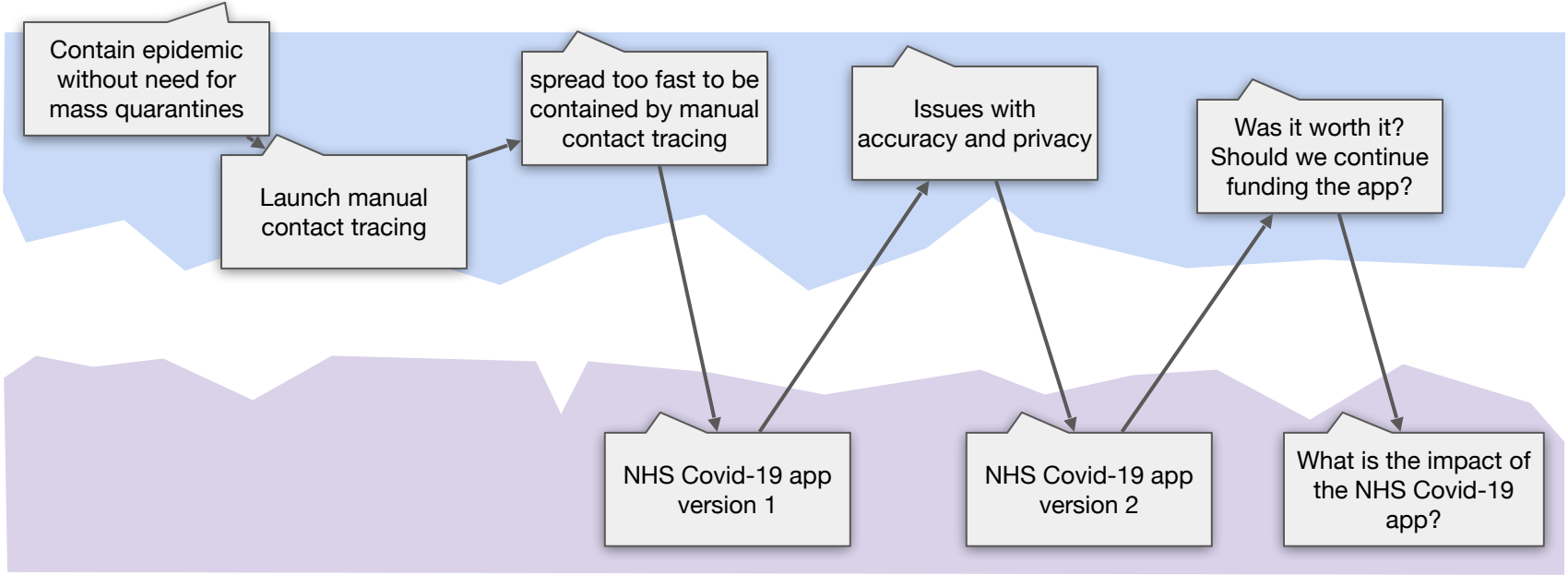

Contain epidemic without need for mass quarantines
Launch manual contact tracing
spread too fast to be contained by manual contact tracing
Issues with accuracy and privacy
Was it worth it? Should we continue funding the app?
NHS Covid-19 app version 1
NHS Covid-19 app version 2
What is the impact of the NHS Covid-19 app?

The Vaccine(s)

https://www.gov.uk/government/speeches/our-vaccination-programme-is-a-national-success-story

GOV.UK

Oral statement to Parliament

Our vaccination programme is a national success story

Delivered on: **2 March 2021**

biggest and fastest vaccination effort the world has ever seen

*The **data** confirms that this strategy is working...*

number of hospital admissions is falling faster than the number of new cases

fall in hospitalisations is faster among the age groups vaccinated

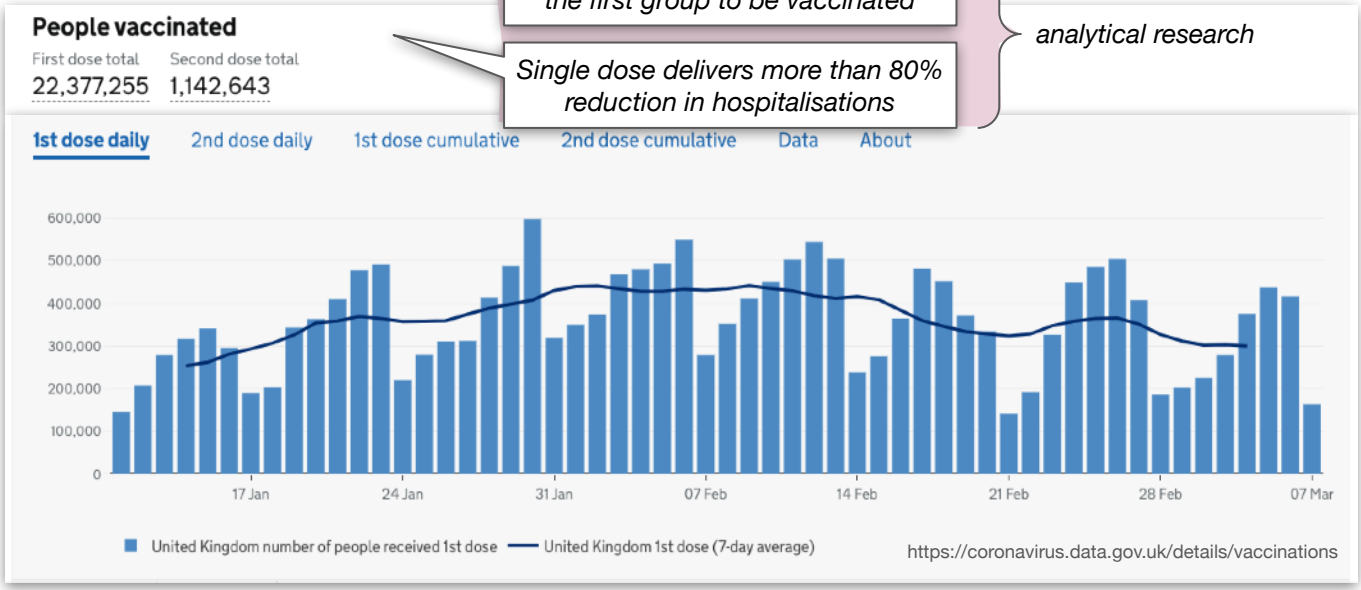
while the fall in cases is decelerating, the fall in the number of deaths is accelerating

real-world data

levels [of antibodies] are highest in the first group to be vaccinated

Single dose delivers more than 80% reduction in hospitalisations

analytical research



https://www.theguardian.com/theobserver/commentisfree/2021/jan/31/behind-the-numbers-how-recipients-of-covid-vaccine-are-prioritised

Behind the numbers: how the recipients of the Covid vaccine are prioritised

David Spiegelhalter and Anthony Masters

who is most at risk of catching and then dying from Covid?

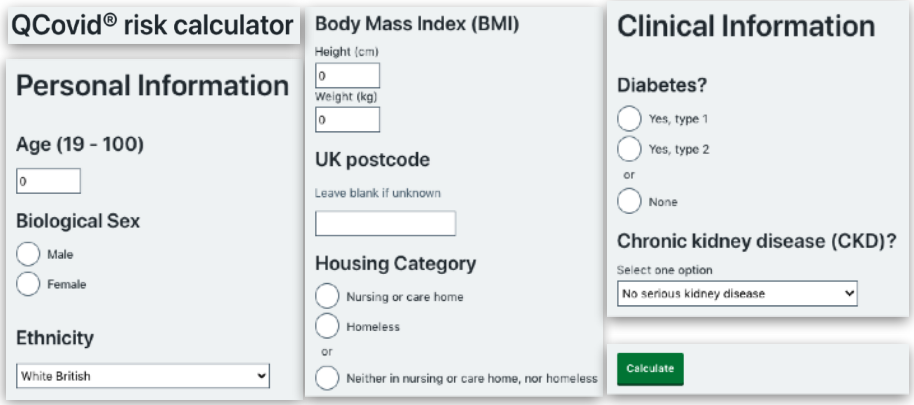
minimise death and severe illness from Covid-19

protect the vulnerable rather than reduce the spread

80% of UK adults are willing to get a vaccine

QCovid® risk calculator

OpenSAFELY



Phase 1 – direct prevention of mortality and supporting the NHS and social care system

1. residents in a care home for older adults and their carers
2. all those 80 years of age and over and frontline health and social care workers
3. all those 75 years of age and over
4. all those 70 years of age and over and clinically extremely vulnerable individuals[footnote 1]
5. all those 65 years of age and over
6. all individuals aged 16 years[footnote 2] to 64 years with underlying health conditions which put them at higher risk of serious disease and mortality[footnote 3]
7. all those 60 years of age and over
8. all those 55 years of age and over
9. all those 50 years of age and over

It is estimated that taken together, these groups represent around 99% of preventable mortality from COVID-19.

https://www.theguardian.com/society/2021/mar/09/scientists-question-nhs-algorithm-as-young-people-called-in-for-jab

Scientists question NHS algorithm as young people called in for jab

Apparent inconsistencies in QCovid risk prediction tool wrongly identifying some patients as high risk

if a patient's weight or ethnicity are not recorded on their health records [...] they are more likely to be invited for a vaccine

For young men, only about 10% of them have their weight recorded, because they barely go to see their GP

Missing data

GPs have reported being contacted by young, healthy patients [who] have been invited for a Covid-19 jab.

False positives

"there were about 10 or 12 patients for whom I couldn't see explanation why they'd been [...] invited for a vaccine. This is causing anxiety"

Explainability

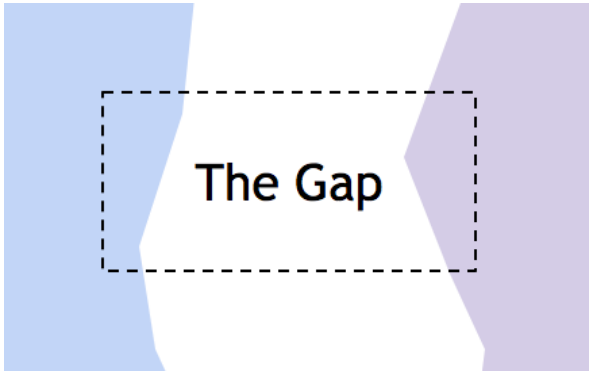
Although it will not harm younger, healthier individuals to receive a jab before their peers, it may mean more vulnerable people have to wait longer for their doses.

Harms

NHS Digital said: "Clinicians can apply their clinical judgment and remove any of these patients from the shielded patient list, and people with concerns can speak to their GP."

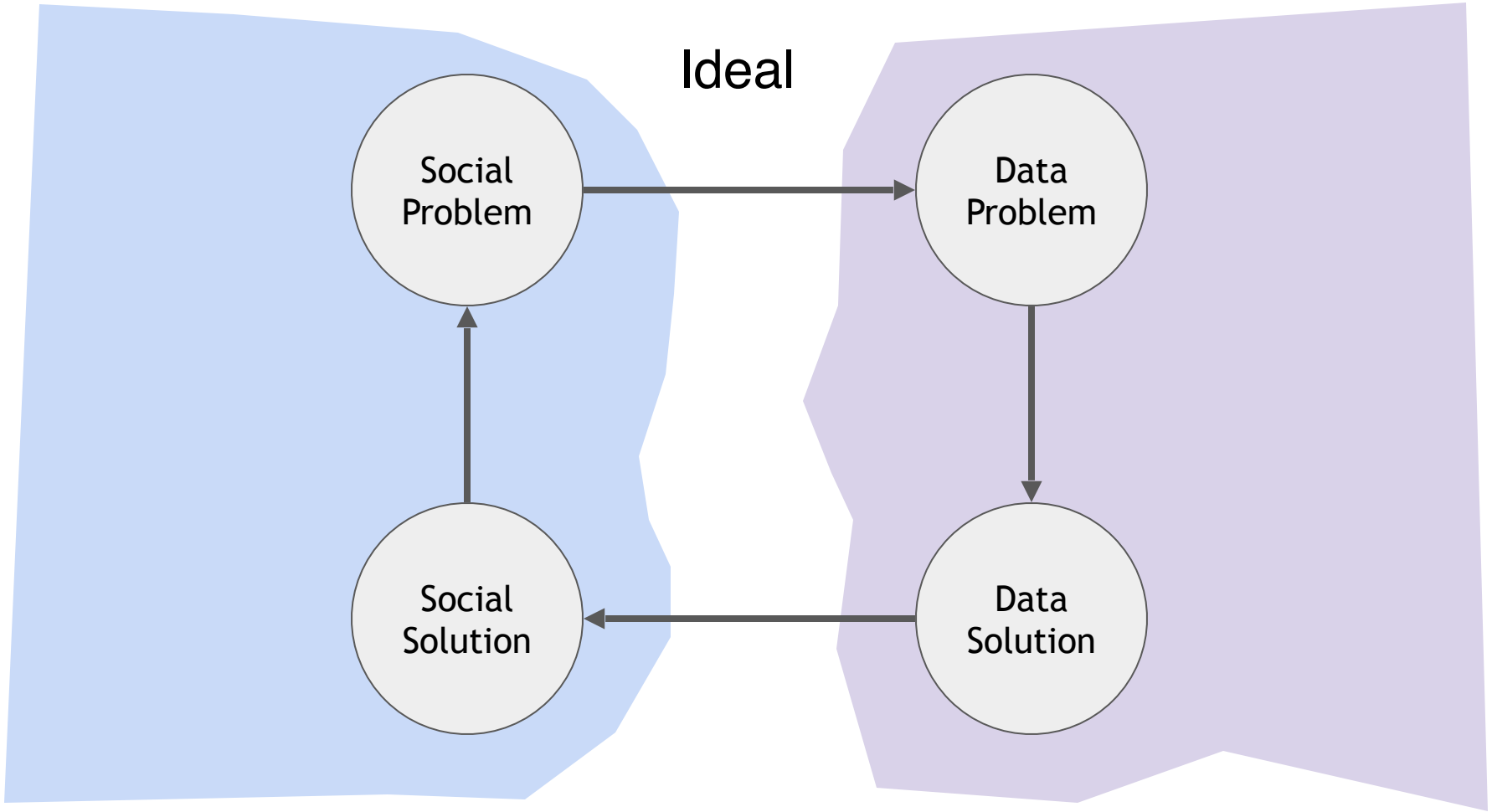
Human in the loop

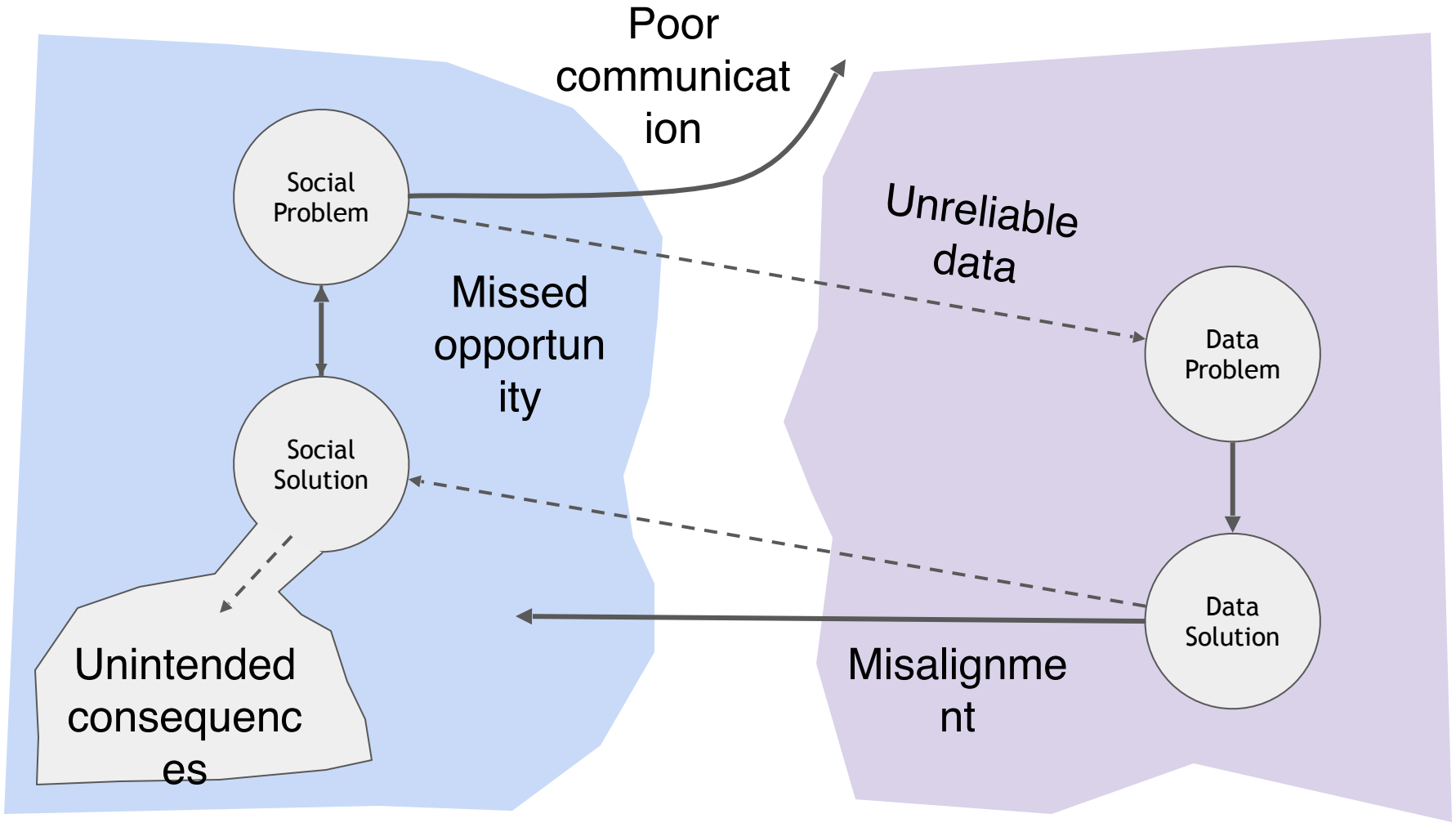
Bridging the Gap



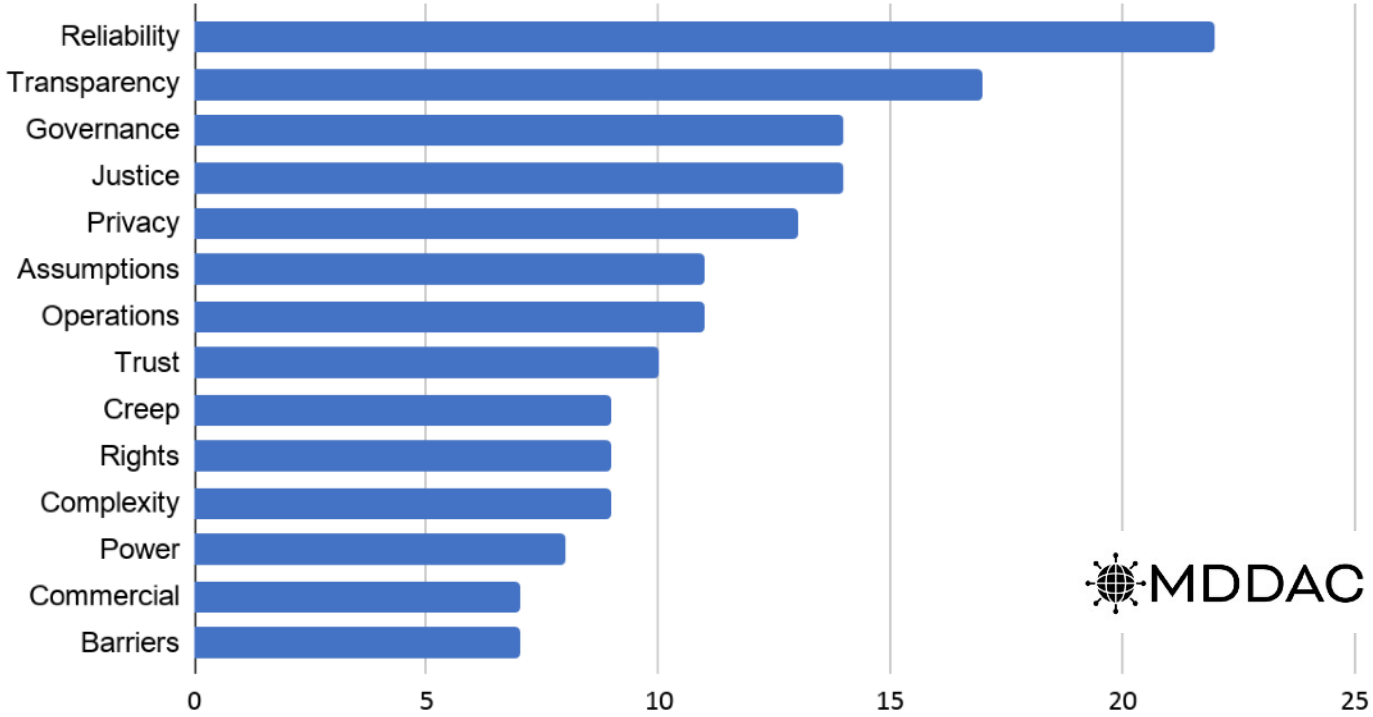
- What are the risks?
- One way ->
- <- the other

What are the risks?

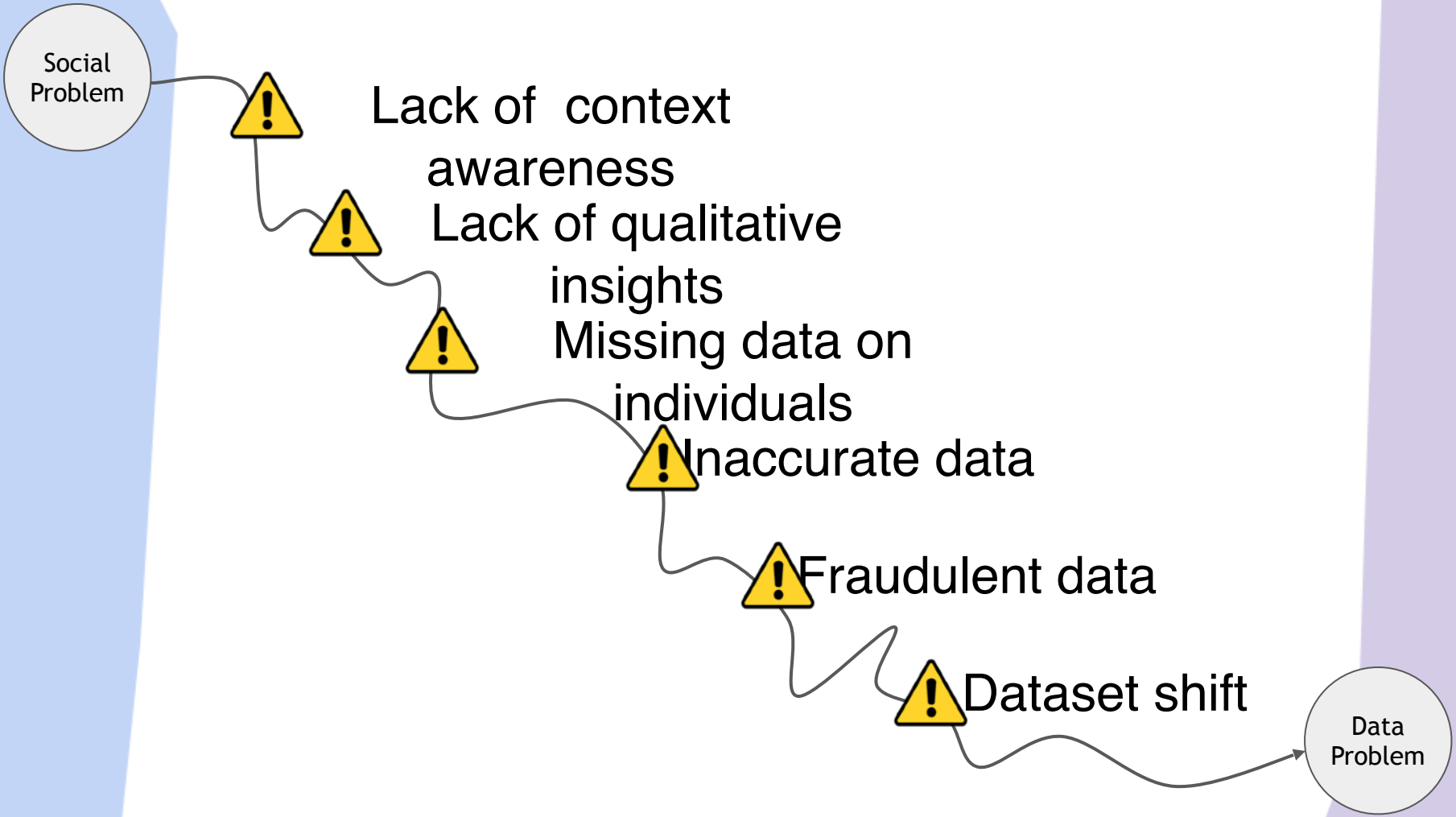

Ideal
Social Problem
Data Problem
Social Solution
Data Solution

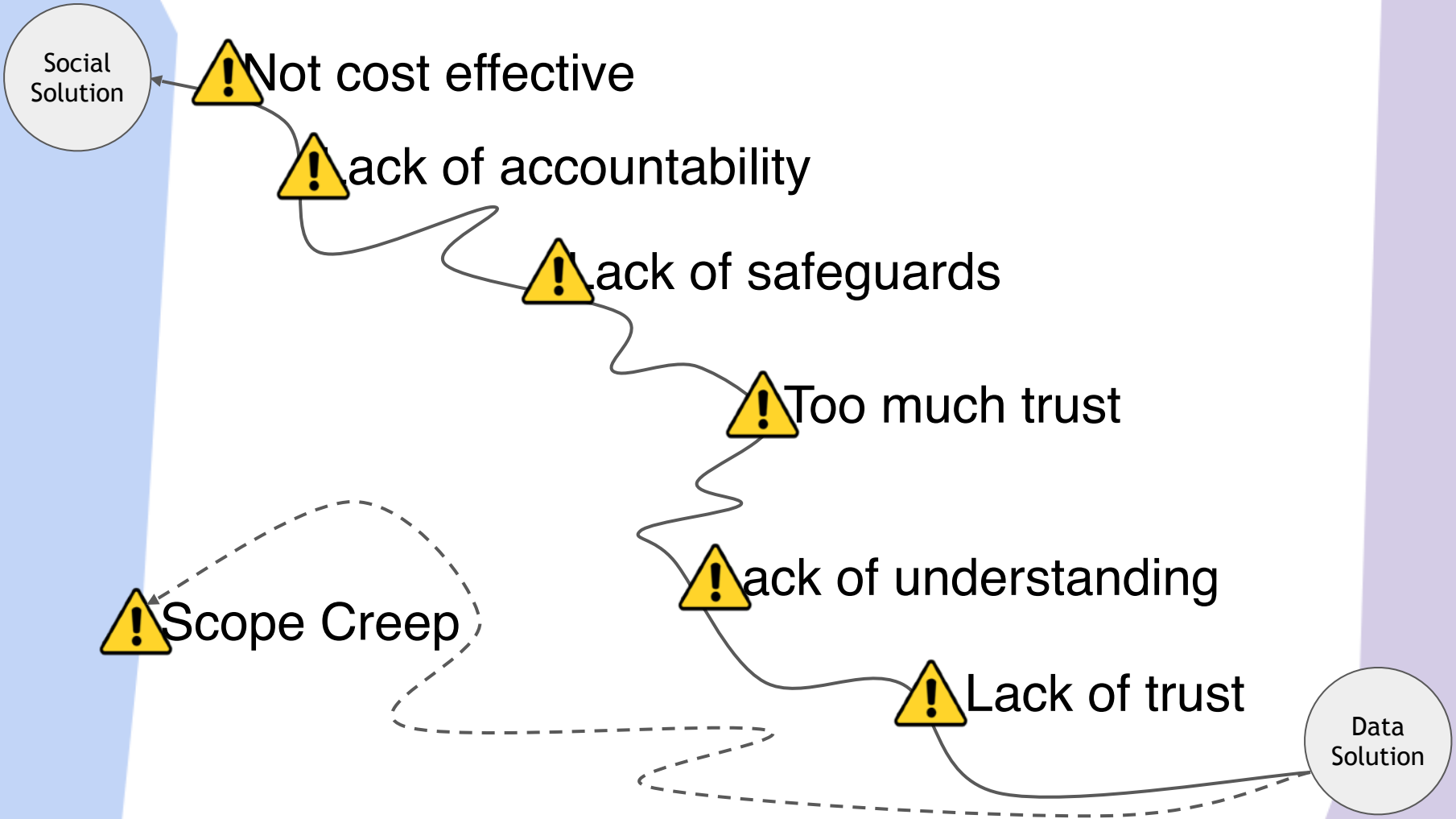

Poor communicat ion
Social Problem
Missed opportun ity
Unreliable data
Data Problem
Social Solution
Data Solution
Unintended consequenc es
Misalignme nt

Number of interviewees who discussed each risk category



MDDAC


Social Problem
Lack of context awareness
Lack of qualitative insights
Missing data on individuals
Inaccurate data
Fraudulent data
Dataset shift
Data Problem


Social Solution
Not cost effective
Lack of accountability
Lack of safeguards
Too much trust
Lack of understanding
Lack of trust
Data Solution
Scope Creep

(Other) key takeaways

- Science has been happening differently
- Good communication is really important
- Bridging the gap is difficult
- Many tools are repurposed
- Now is a good time to be a data scientist

OMDDAC