

Managing complexity in evaluation

Managing (struggling with?) complexity in evaluation

- Three presentations:
 - Complexities in conducting an economic evaluation of the NHS social prescribing scheme: The Data Block. **Dr Efundem Agboraw, University of Manchester**
 - Commissioning decisions in the context of Mobile Stroke Units: Using a digital web application to understand complexity. **Dr Jason Scott, Northumbria University**
 - COMPLEX-IT: An AM-SMART Platform for non-expert use of computational methods for data exploration. **Prof Brian Castellani, University of Durham**
- Questions, answers and your own experiences of managing complexity



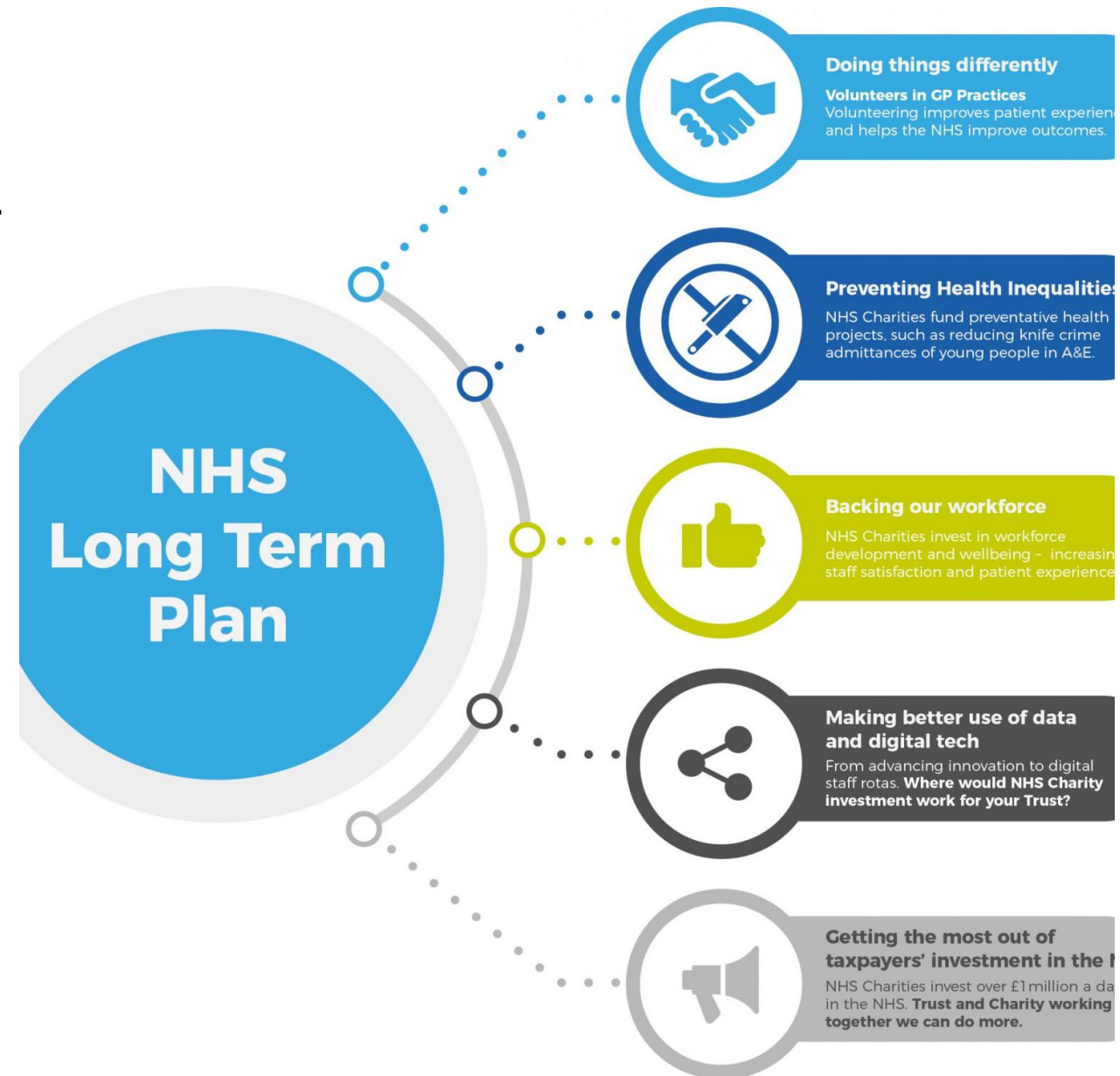
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Complexities in conducting an economic evaluation of the NHS social prescribing scheme: The Data Block

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Introduction

- Pre 2019, Social prescribing was conducted in some English regions by local authorities, voluntary sector and some general practices.
- The NHS Long term plan was introduced in 2019, to improve health outcomes
- Prominent part of the plan was the Additional roles reimbursement scheme, aimed at recruiting additional roles to support the health system in achieving long term plan
- Social prescribing link workers (SPLWs) were one of the first roles funded by the scheme



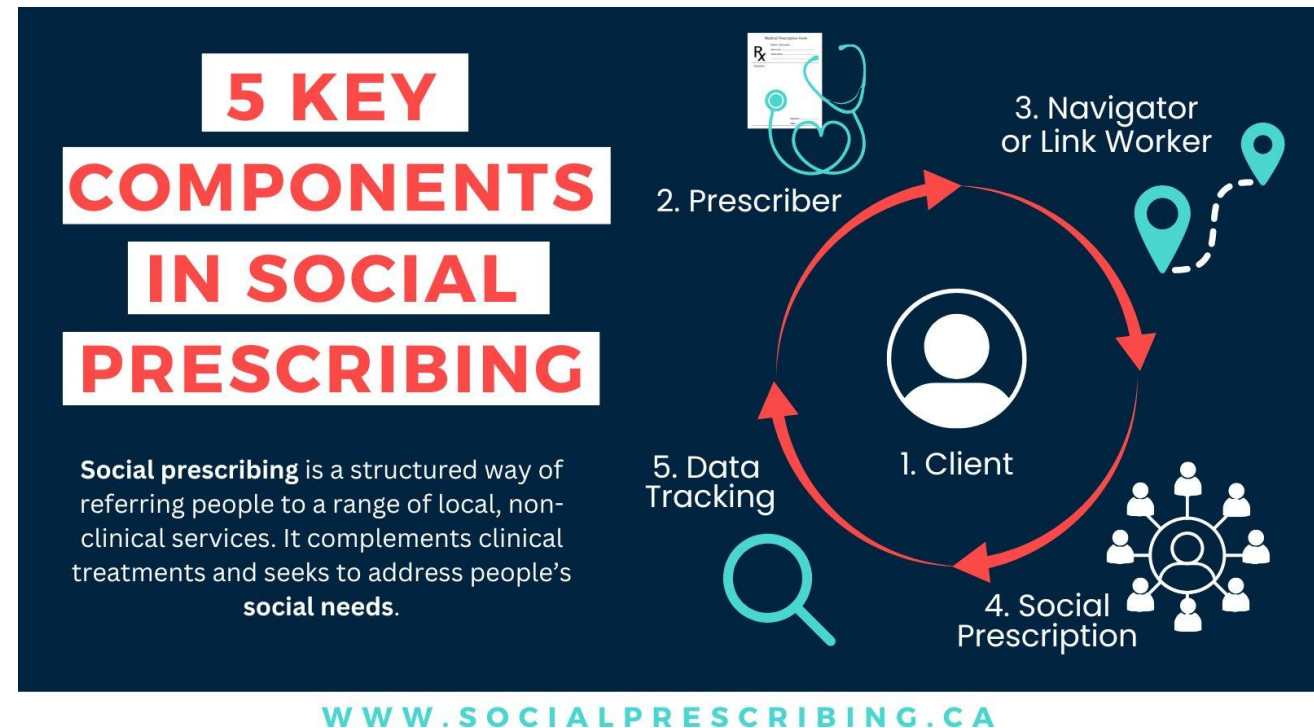
Introduction

- Primary care networks (PCNs) were also introduced, pooling together GPs in geographical units, to enable easier management of health funding and decisions from the NHS.
- In 2022, each PCN was encouraged to have a social prescribing service and recruit SPLWs, funded by the ARRS.
- Hence SPLWs under the ARRS were recruited at the PCN level



**Social Prescribing
Service**

- Social prescribing is a service where a health professional refers a patient to a link worker who will develop a personalised care plan with the patient and refer to recommended community activities to improve health and well being of patient.
- Aimed at people with
 - Long term conditions
 - Complex social needs
 - Mental health needs
 - Financial debt issues
 - Housing
 - Employment



Social Prescribing Scheme: Activities



Social prescribing: the complex intervention

- Social prescribing is a complex and multidimensional intervention, operating in a non-linear, dynamic and complex system with varying structural mechanisms.
- “Social prescribing is not one intervention, ...it is an umbrella term that encompasses interventions that are asset-based, person-centred and typically involve a named professional who supports the person and helps link services and agencies involved in their care” (Wood et al 2021)
- Diverse client base; long term health conditions, mental health, complex social needs, employment, finance, housing, bereavement, learning difficulties
- Multiple stakeholders (perspectives) acting different roles, for different objectives and different outcomes: multiagency involvement

Social prescribing: the complex intervention

- Varied and interlinked set of outcomes for multiple stakeholders: Varying contexts influence how individuals respond to the different parts of social prescribing, at different times and its resulting outcomes.
- These outcomes, based on wider social determinants of health, have interaction, feedback and spill over effects, that impact multiple areas of person's life, the health system and the community. Hence mechanisms in which outcomes are achieved are uncertain
- Woods et al (2021) describe this complexity through the individual Context (C), and underlying Mechanisms (M) that shape patterns of outcomes (O) (CMO) for social prescribing

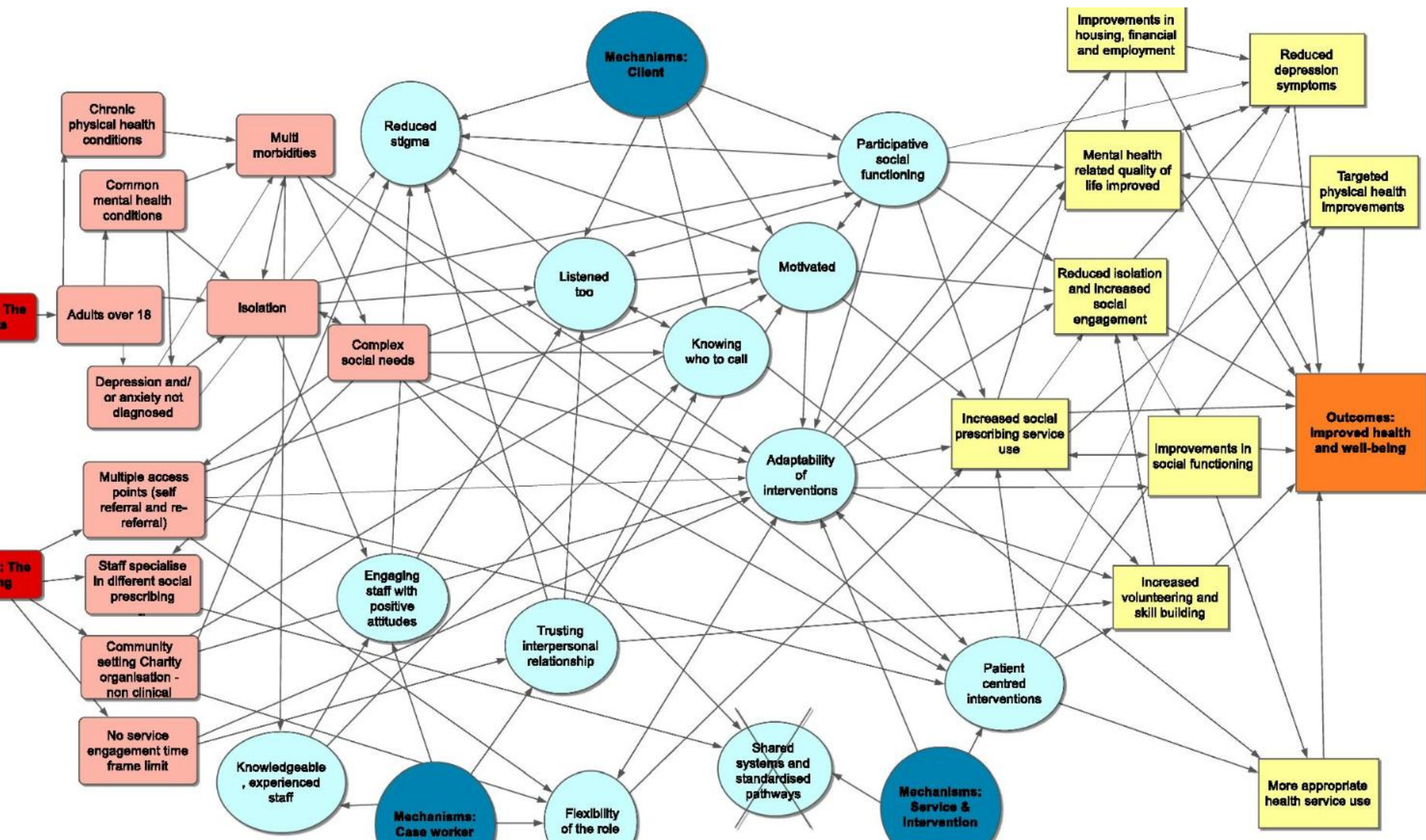
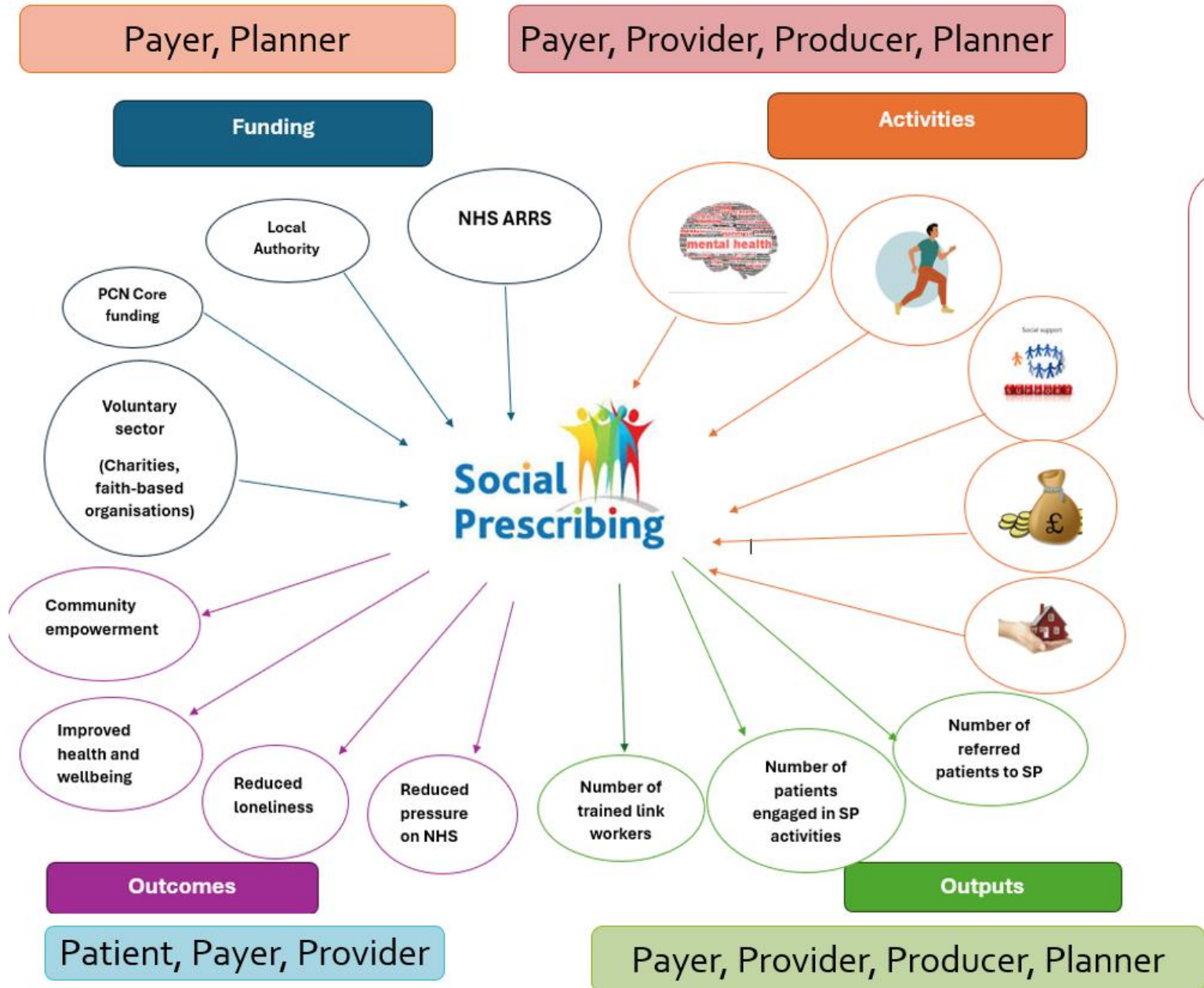


Illustration of CMO of social prescribing by Woods et al (2021)

Social prescribing: Perspectives

- According to Wildman & Wildman 2019, there are 5 perspectives (5Ps) to social prescribing;
 - The Patient
 - The Payer (funding)
 - The Provider (social prescribing activities)
 - The Producer (social prescribing activities, train link workers)
 - The Planner (plan social prescribing service, funding)
- All 5Ps are interlinked on terms of expected outcomes and associated costs



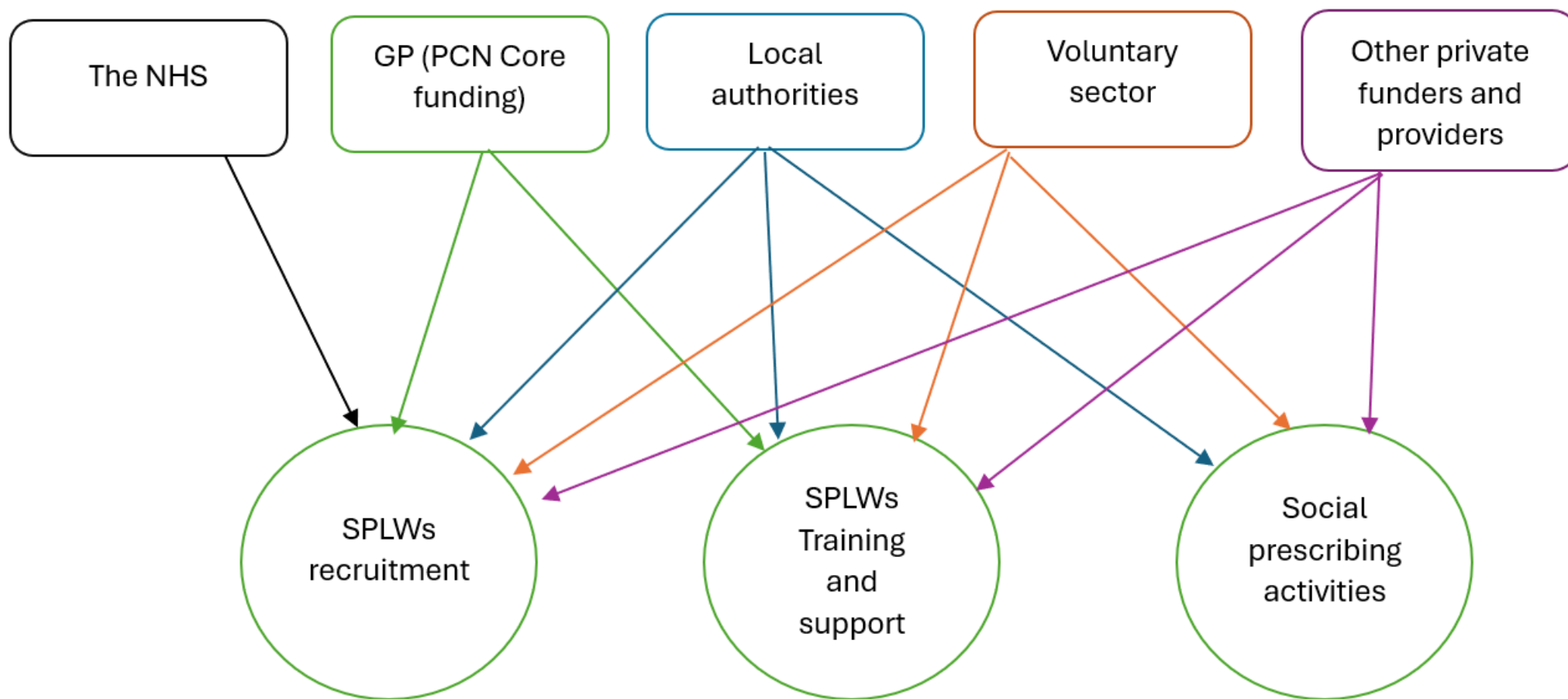
Traditional economic evaluations of health interventions assess the full cost of the intervention against its outcome/effectiveness.
However, for social prescribing.....



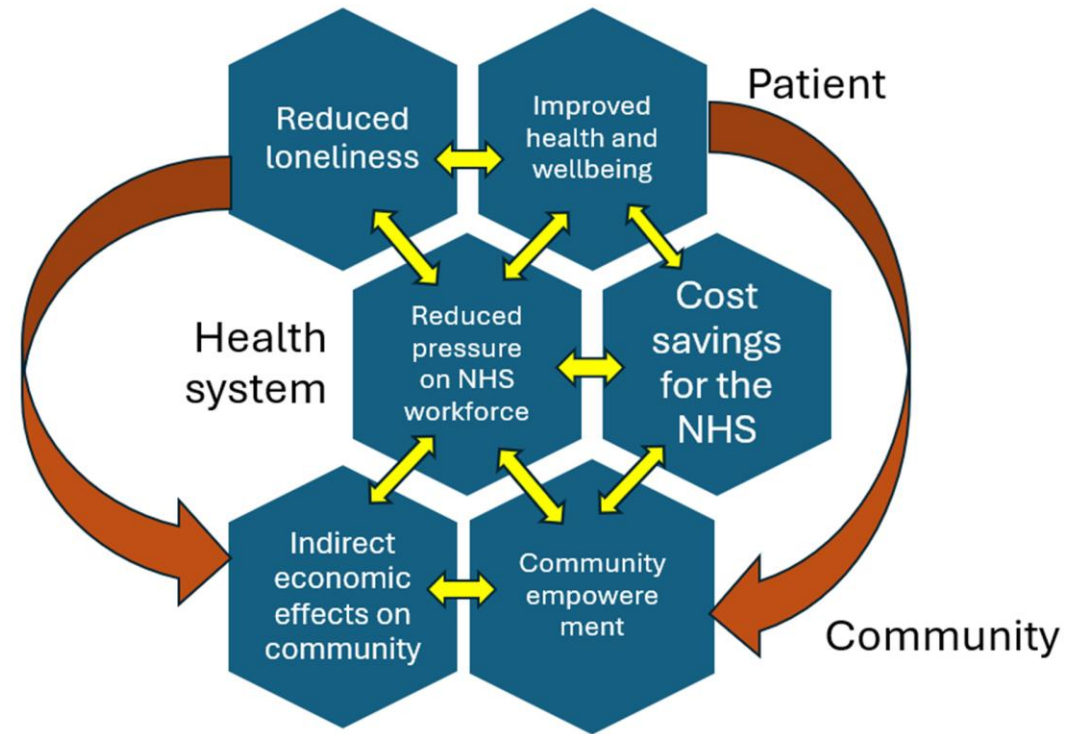
Data collection depends on...

- What we need to know; costs and outcomes/effectiveness of social prescribing
- Where the available data is: Cost files of the funder, healthcare records, surveys, local datasets, data records of the provider etc
- Frequency of data collection; monthly, annually, after two, three, four years
- Complexities around data collection: data access (ethics, data user environments), conditions on linkages
- Intended analysis ; Economic evaluation (different types)
- Resources and time available; dependent on research funding conditions and contracts

- NHS funds only recruitment of SPLWs hence costs could be found on NHS reports and documents found on NHS websites.
- Other costs of social prescribing are found in datasets of local and voluntary service providers



- **Expected outputs and outcomes**
- Outcomes for social prescribing are measured from the 5Ps, which can be further categorised into the patient, health system and community perspective.
- Given the complexities of social prescribing, the measure of outcomes/effectiveness data on outcomes are widespread and interconnected



Outcomes data

- Social prescribing data have only been recently included in databases such as the Clinical Practice Research Datalink (CPRD) (through SNOMED codes), English Longitudinal Study of Aging (ELSA) (social prescribing activities and self reported health) and Elemental.
- National surveys such as the GP Patient surveys (GPPS) and Annual population survey (APS), have data on population outcomes that can be linked to social prescribing (confidence in managing long term conditions, support and other wellbeing outcomes)
- Hospital Episode Statistics (HES) and NHS workforce, also have data which can be used for economic evaluation of social prescribing

Outcomes data from health care records and surveys

Data relevant to social prescribing evaluation

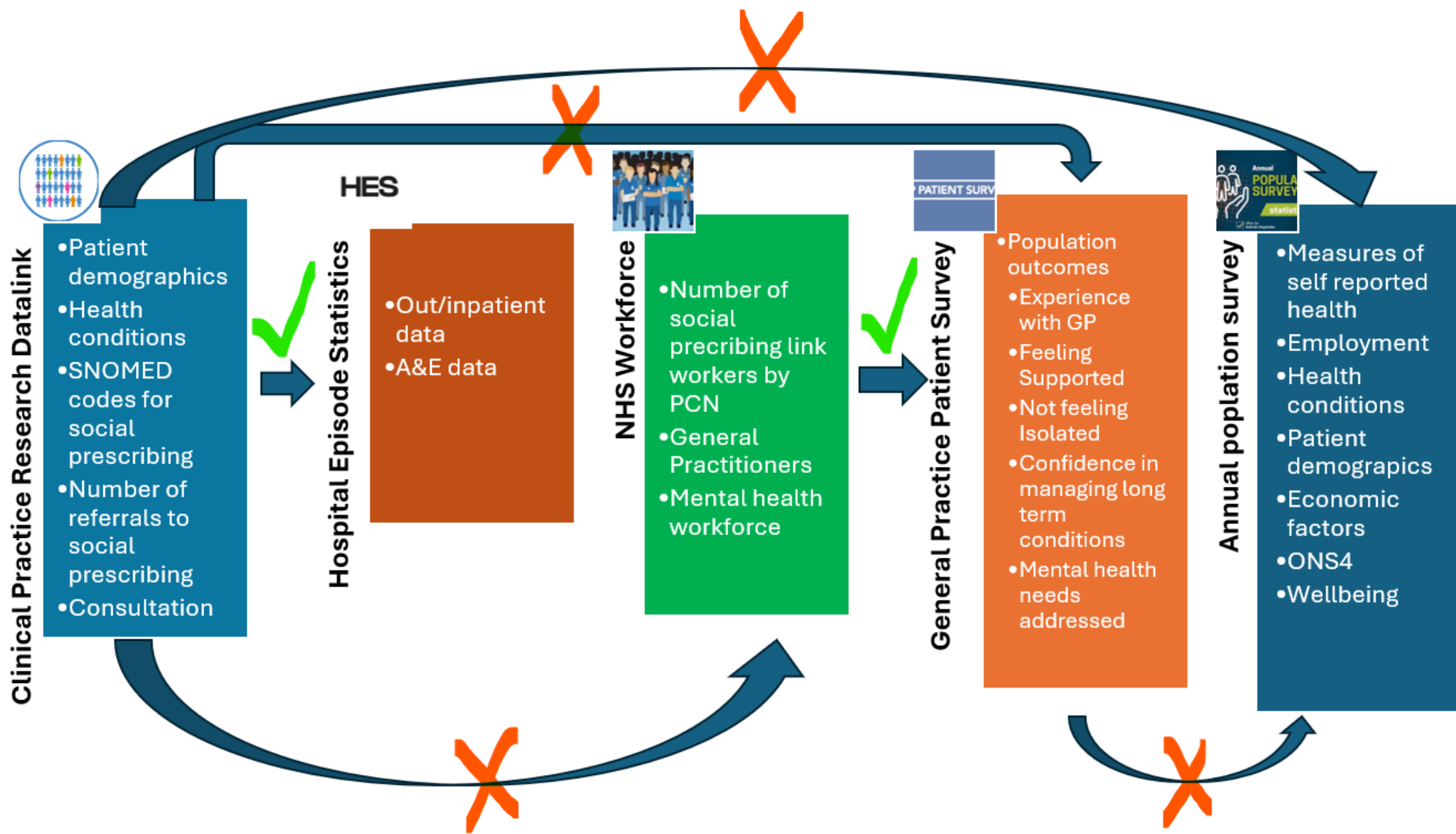
CPRD	GPPS	APS	ELSA	Elemental	HES	NHS Workforce
Patient demographics	Patient demographics	Patient demographics	Patient demographics	Patient demographics	Patient demographics	PCN, ICB characteristics
Long term health conditions	Confidence in managing long term conditions	Long term health conditions	Long term health conditions	ONS4 data	Outpatient/inpatient data	Number of SPLWS annually
SNOMED codes for social prescribing	Feeling supported	Employment	Social prescribing referrals	Social prescribing referrals	A&E attendance	Number of GPs annually
Social prescribing referrals per year per GP	Not feeling isolated	ONS4 Wellbeing	Social prescribing activities attendance	Social prescribing activities attendance	Hospital bed days	Mental health practitioners
GP appointments/consultations	Mental health needs addressed		Self reported health (physical and mental)			Pharmacists

How well do these outcome data capture impact?

- Outcome data collection is more unobtrusive than obtrusive hence,
 - Is the available data collected meant to measure impact of social prescribing?
 - For survey questions; are the questions posed to capture impact of social prescribing.
 - If yes, how well does the measure capture impact of social prescribing?
 - Is the measure believable?
 - Clinical vs population outcomes
 - Does the data have precision and stability? Will the data achieve the same result from repeated evaluations?

Pooling data

- To have a wholistic evaluation of social prescribing, (both costs and outcomes/effectiveness) data pooling and linkages are required.
- However, difficulties are faced with restrictions to data access and data linkages within health care datasets and between local data and health care records.
- Some datasets are accessed under the secure user environment, which is centrally monitored, hence no freedom to merge data with “foreign” datasets



Cost-savings to NHS

CPRD.
Referrals to
Social
prescribing

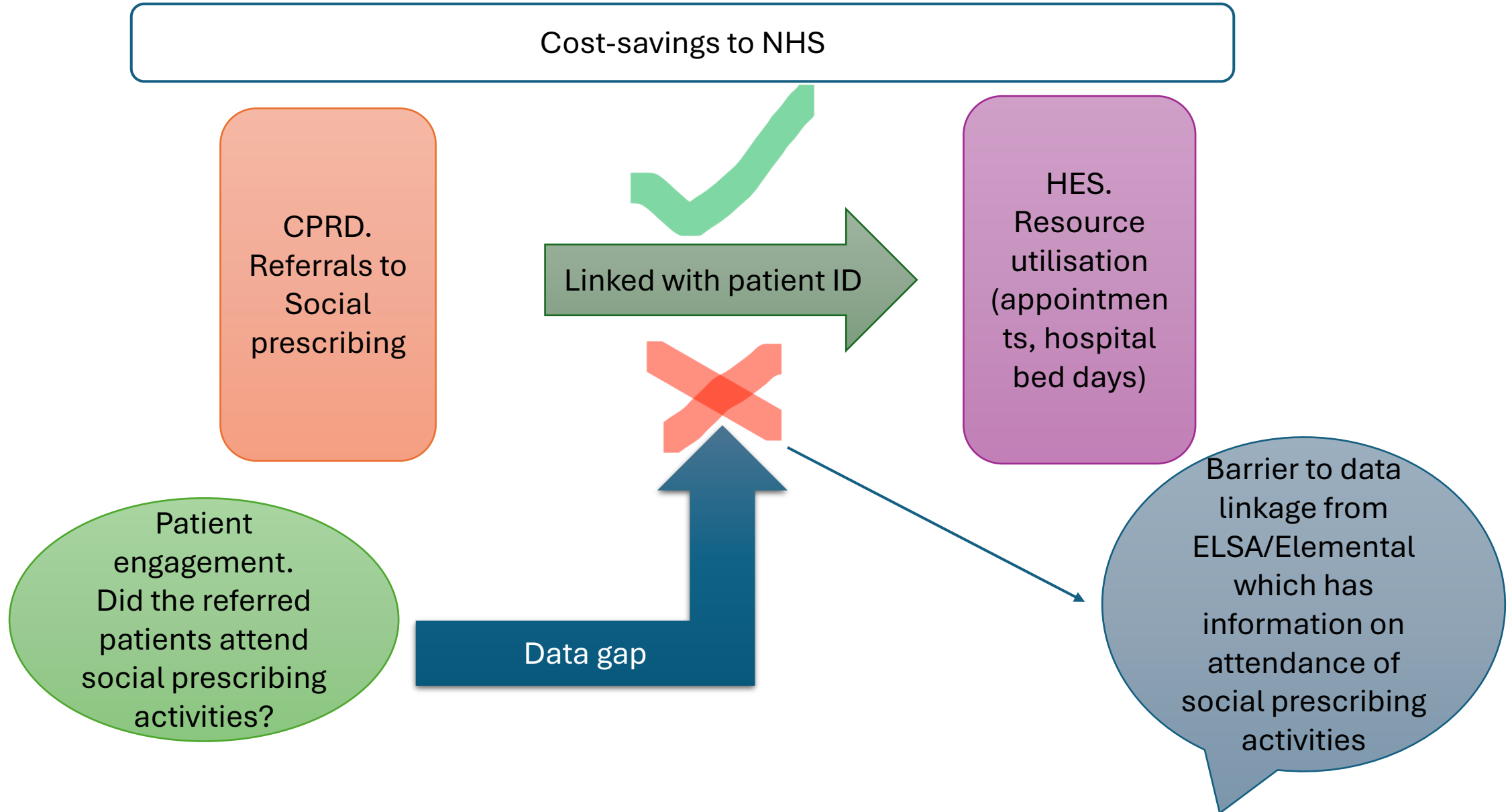
Linked with patient ID

HES.
Resource
utilisation
(appointmen
ts, hospital
bed days)

Patient
engagement.
Did the referred
patients attend
social prescribing
activities?

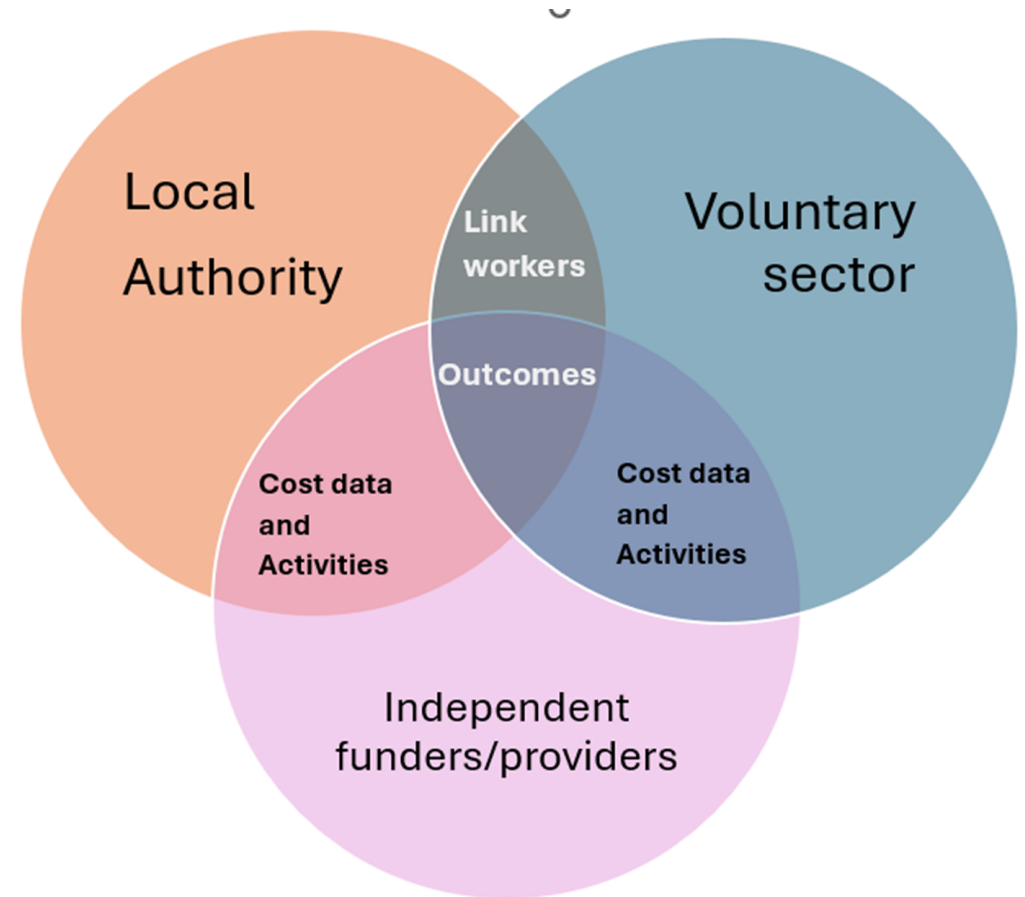
Data gap

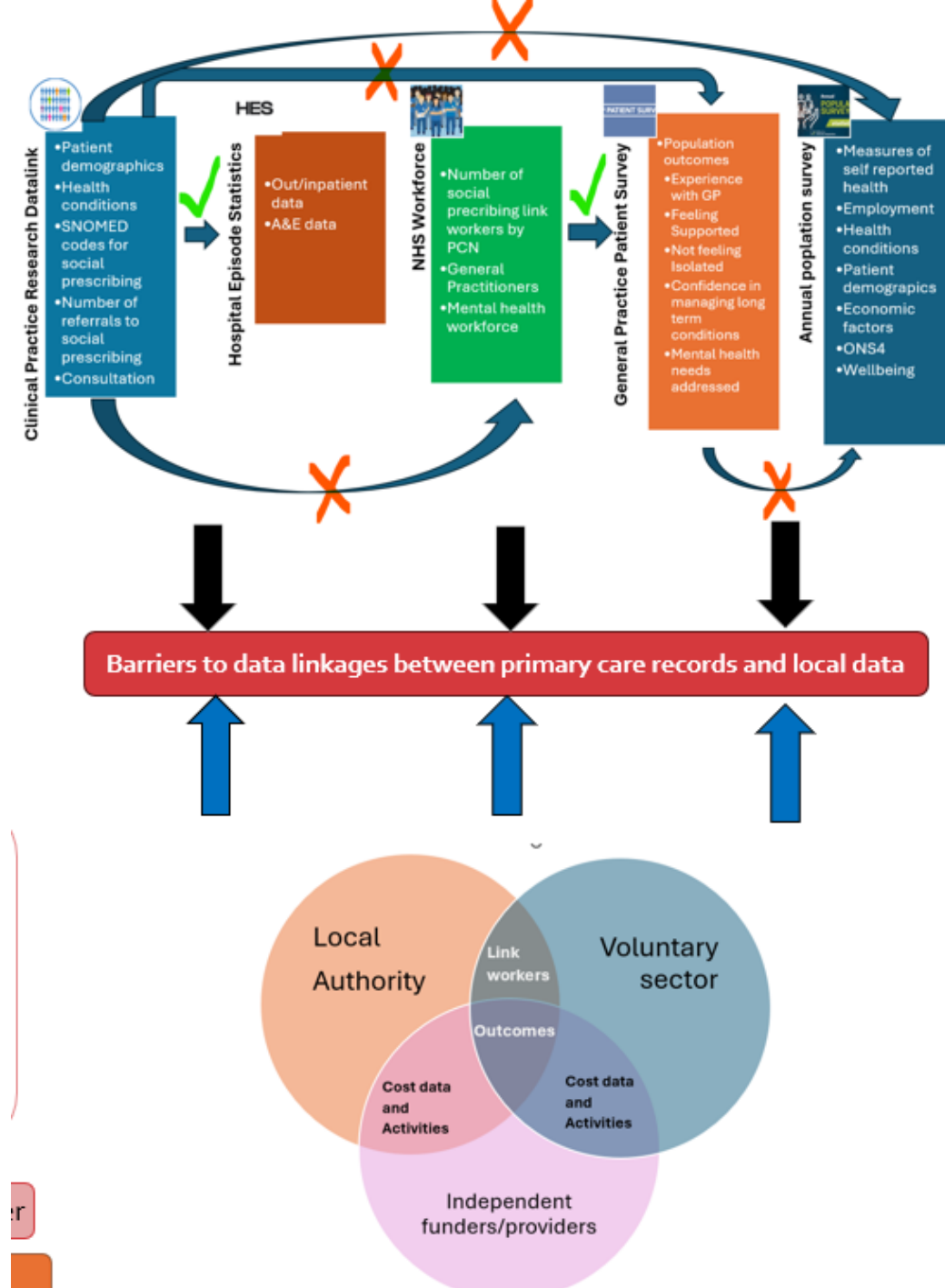
Barrier to data
linkage from
ELSA/Elemental
which has
information on
attendance of
social prescribing
activities



Local data

- All outputs and outcomes for social prescribing are still fragmented and found in the databases of the Providers, Producers and planners.
- Data recording is done at multiple levels (vertically and horizontally) with overlaps which could lead to data duplication and/or missing data.
- Access to local datasets are currently restrictive depending on the local authority



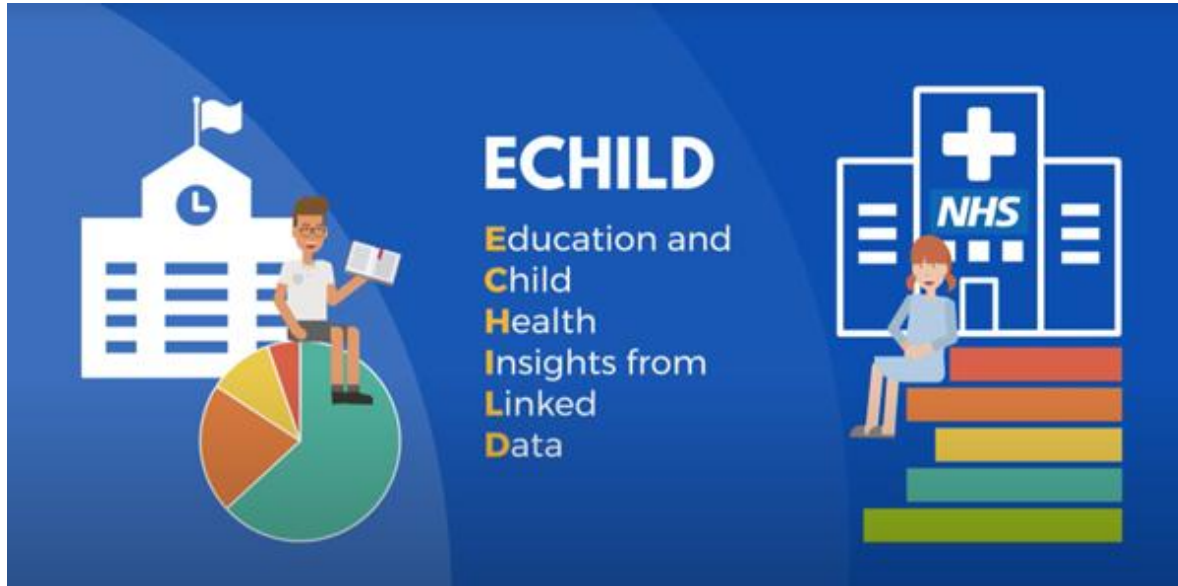


Past economic evaluations of social prescribing

- As a result of the above-mentioned challenges with data availability most economic evaluations of social prescribing...
 - Have been small pilot studies and interventions, for specific patient cohorts (mental health, dementia, depression/anxiety etc)
 - Have control over the type of data needed; patient recruitment, baseline data, treatment/control group, link worker recruitment, intervention data collection and endline data.
 - Ability to follow patient from baseline, through intervention to endline, gathering vital information on effectiveness and cost of the intervention.
 - Conducted cost-savings analysis, return on investment, CBAs and CEA (1 paper).
- Attempts at national economic evaluations have been limited to cost-savings for the NHS using CPRD and HES data.

How can we manage complexity and data blocks in social prescribing evaluation?

- Improved and standardized data collection (e.g standard SNOMED codes) across all levels social prescribing within the health system, capturing a holistic view of the inputs (costs) and outcomes of social prescribing.
- Structure for routine data collection from health system on
 - link worker data,
 - costs to funders. planners, providers,
 - details on referrals
 - onward prescribed activities
 - patient engagement



- Harmonised data collection outside the NHS (local authorities, voluntary sector) gathering data on different aspects of social prescribing
- Development of a database bringing in all data, tailored for social prescribing from within and out of the NHS, linking data on vital information about the patient/client's journey through social prescribing to the desired outcomes
- An example is the ECHILD database with linked data on children from birth.

References

- Wildman, J. and J.M. Wildman, Combining Health and Outcomes Beyond Health in Complex Evaluations of Complex Interventions: Suggestions for Economic Evaluation. Value in Health, 2019. 22(5): p. 511-517.
- Wood, E., Ohlsen, S., Fenton, SJ. et al. Social prescribing for people with complex needs: a realist evaluation. BMC Fam Pract 22, 53 (2021). <https://doi.org/10.1186/s12875-021-01407-x>

A blue ballpoint pen is shown in the process of writing the words "Thank you!" in a black, cursive script on a white, slightly textured surface. The pen is positioned at the end of the word "you!", with its tip touching the paper. The lighting is soft, creating a subtle shadow of the pen on the surface.

Thank you!

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Commissioning decisions in the context of Mobile Stroke Units: Using a digital web application to understand complexity

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NIHR | National Institute for
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Brief context: Mobile Stroke Units



<https://www.youtube.com/watch?v=u-68Uc-4NKk:>



https://www.youtube.com/watch?v=8AcoSURG7eo&ab_channel=CBCNews%3ATheNational:



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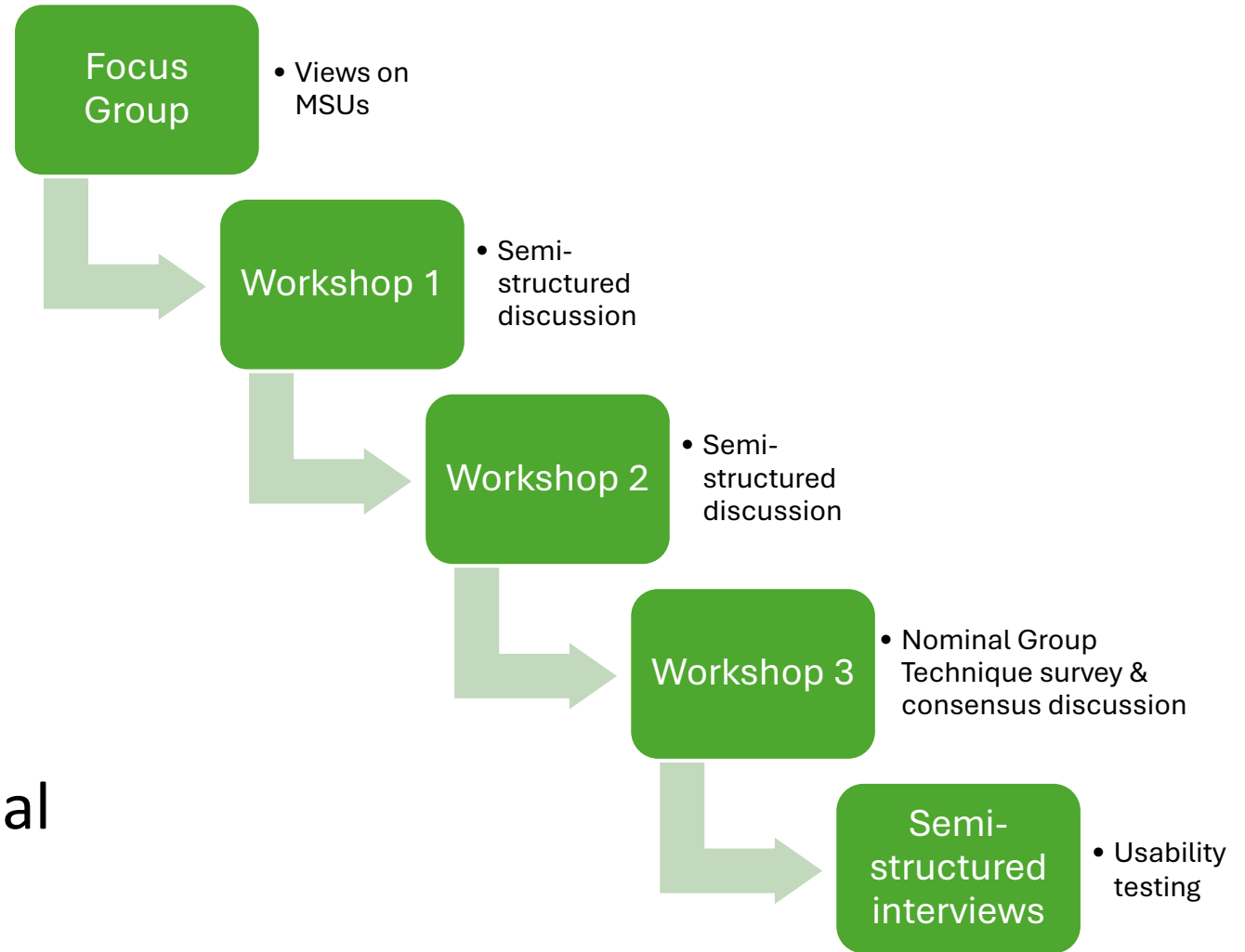
Aim

Inform policymakers' decisions about whether to deploy mobile stroke units in the English and Welsh NHS, where they might be deployed, when they might be deployed and what the consequences will be.



Study design

- Sequential equal status mixed methods design
- Three workstreams broadly comprising of qualitative, quantitative, and economic methodologies.
- Focus group plus modified Nominal Group Technique to obtain consensus (workshops)
- Qualitative usability testing



Participants & sampling

- Purposive sampling of stakeholders:
 - Stroke physicians with experience of working in Comprehensive Stroke Centres and/or Acute Stroke Services
 - Paramedics with stroke expertise
 - People involved in commissioning decisions
 - Patient and public representatives
- Geographically dispersed across England and Wales



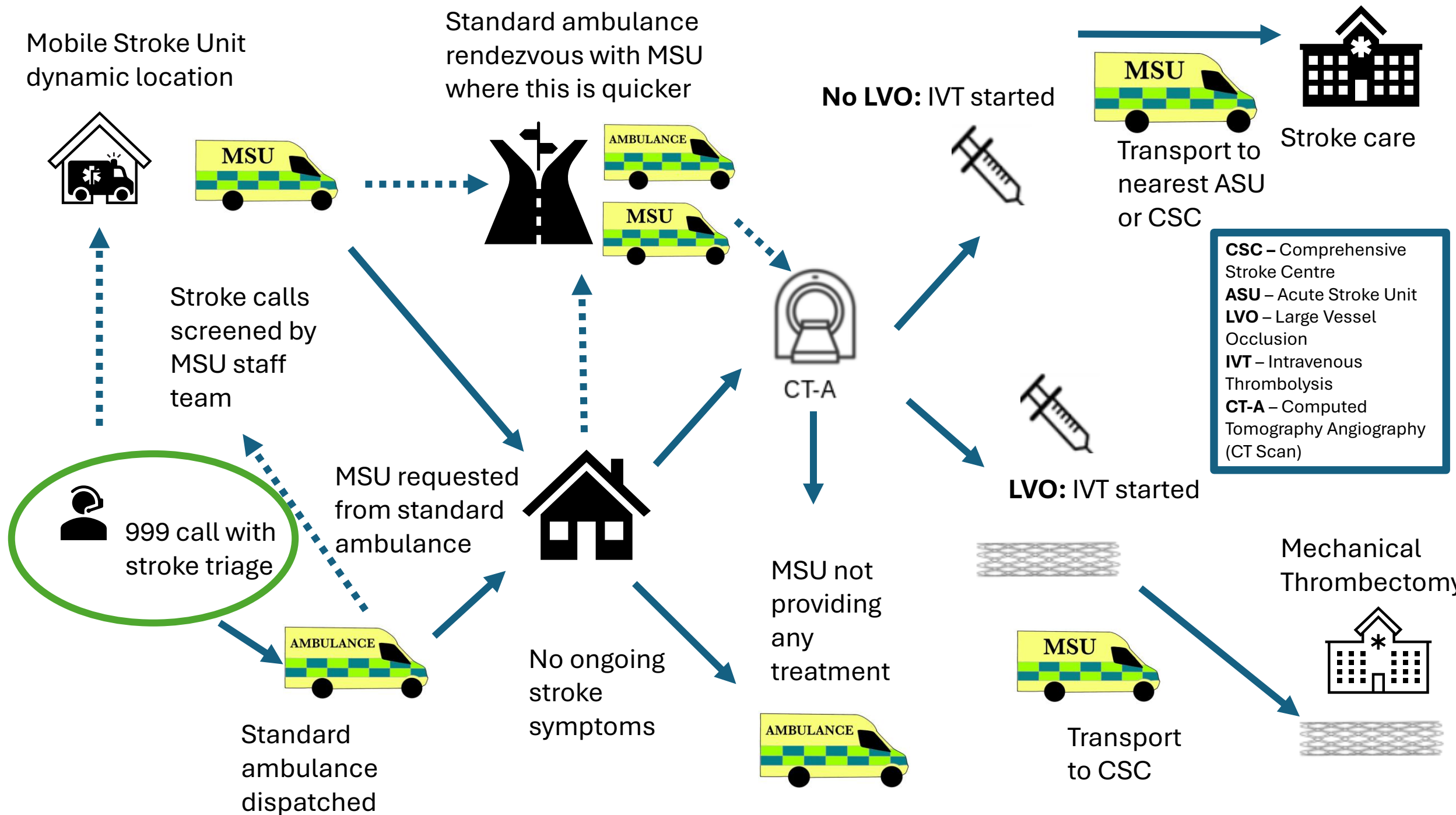
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Proposed MSU pathway

- Managed by ambulance service and dynamically located
- Staffed by paramedic, radiographer, stroke nurse, care assistant
- Stroke physician input via telemedicine
- Multiple dispatch mechanisms



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Key implementation challenges

Staffing

Telemedicine
connectivity

Triage
sensitivity and
specificity

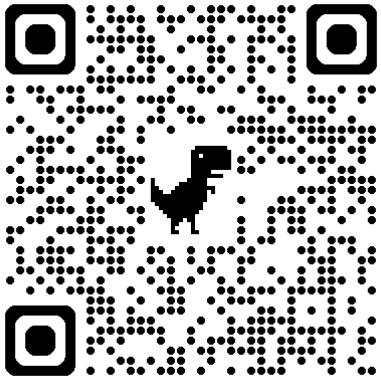
Location and
demand

Service
availability
(days / hours)

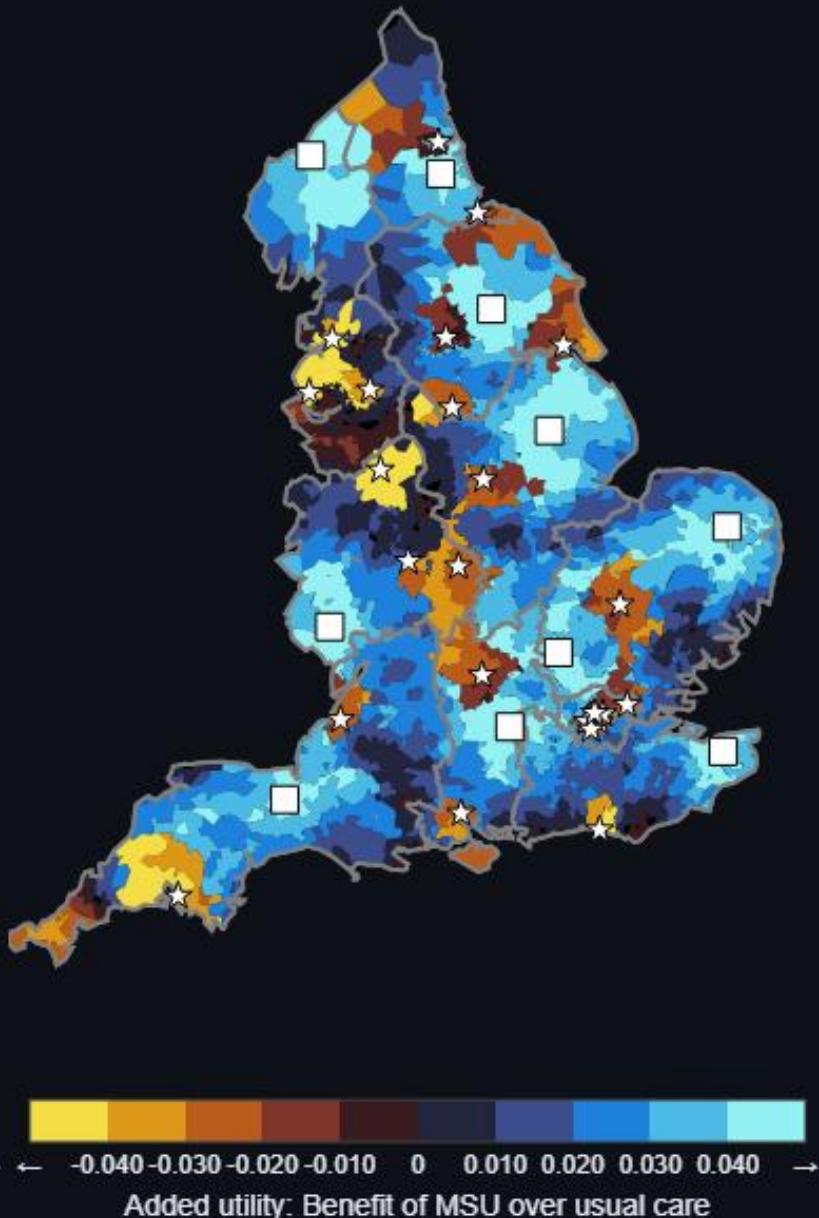
Impact on
equitable
access

Public
awareness

Pre-print paper:



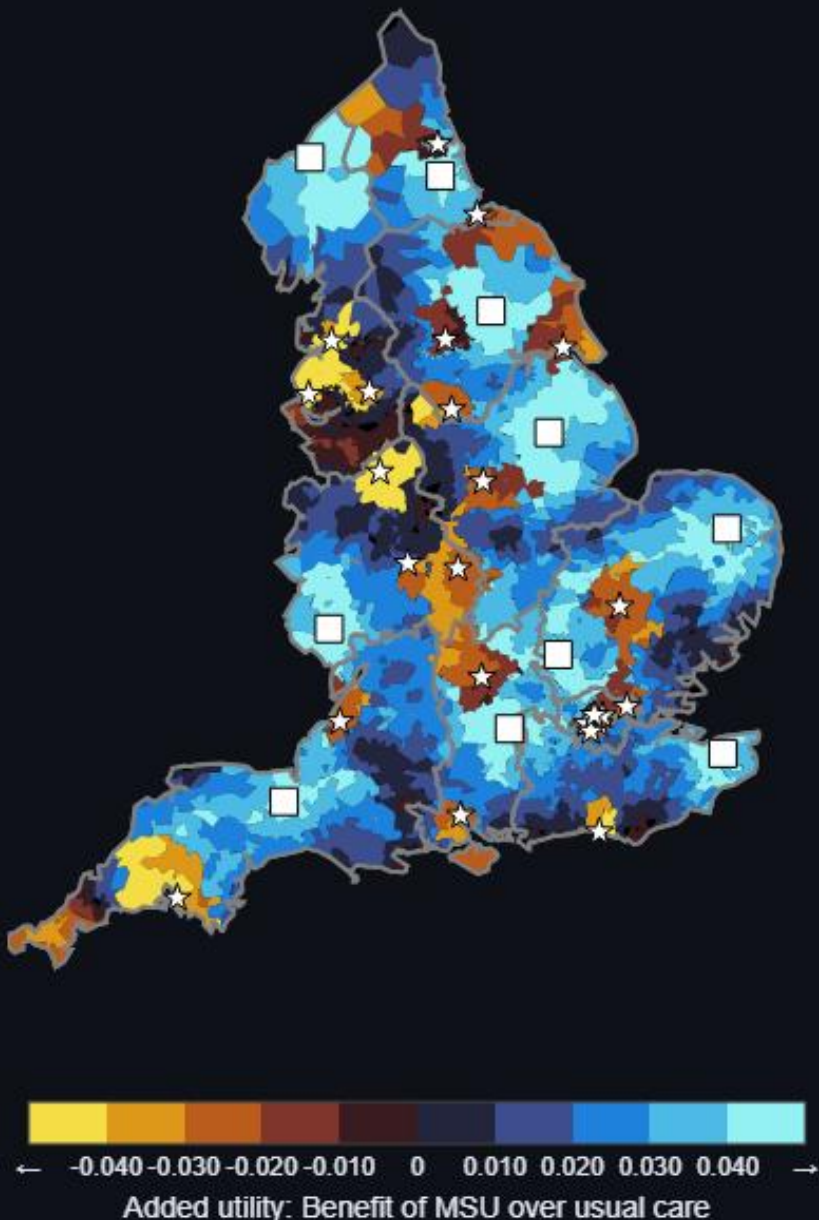
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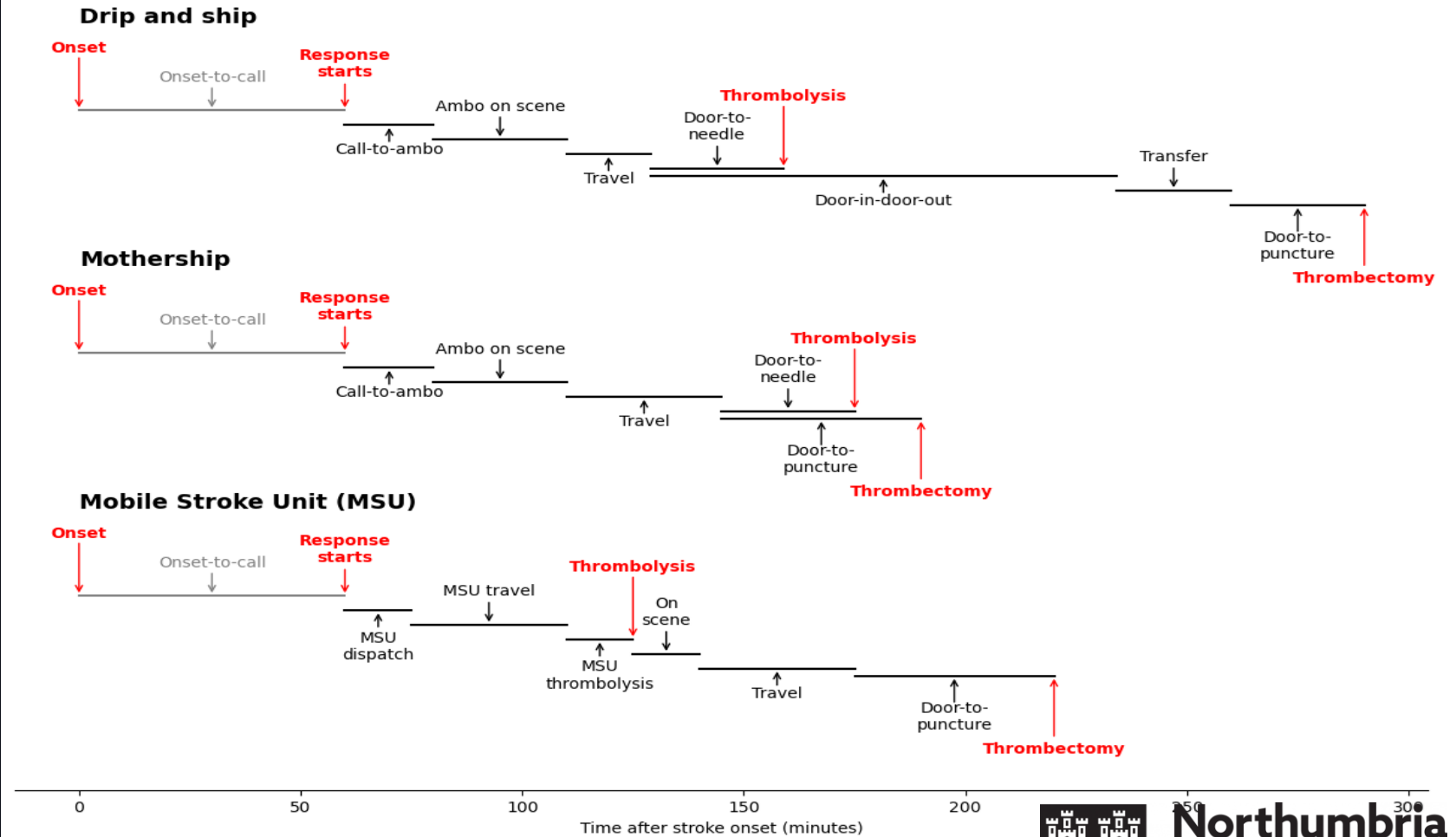
Web application design

- Model code development on GitHub and Streamlit used as deployment platform
- Able to produce ‘live’ models with modifiable parameters
- Some limitations, ie dynamic locations of MSUs
- Based on maximum patient benefit





Developed consensus on model parameters

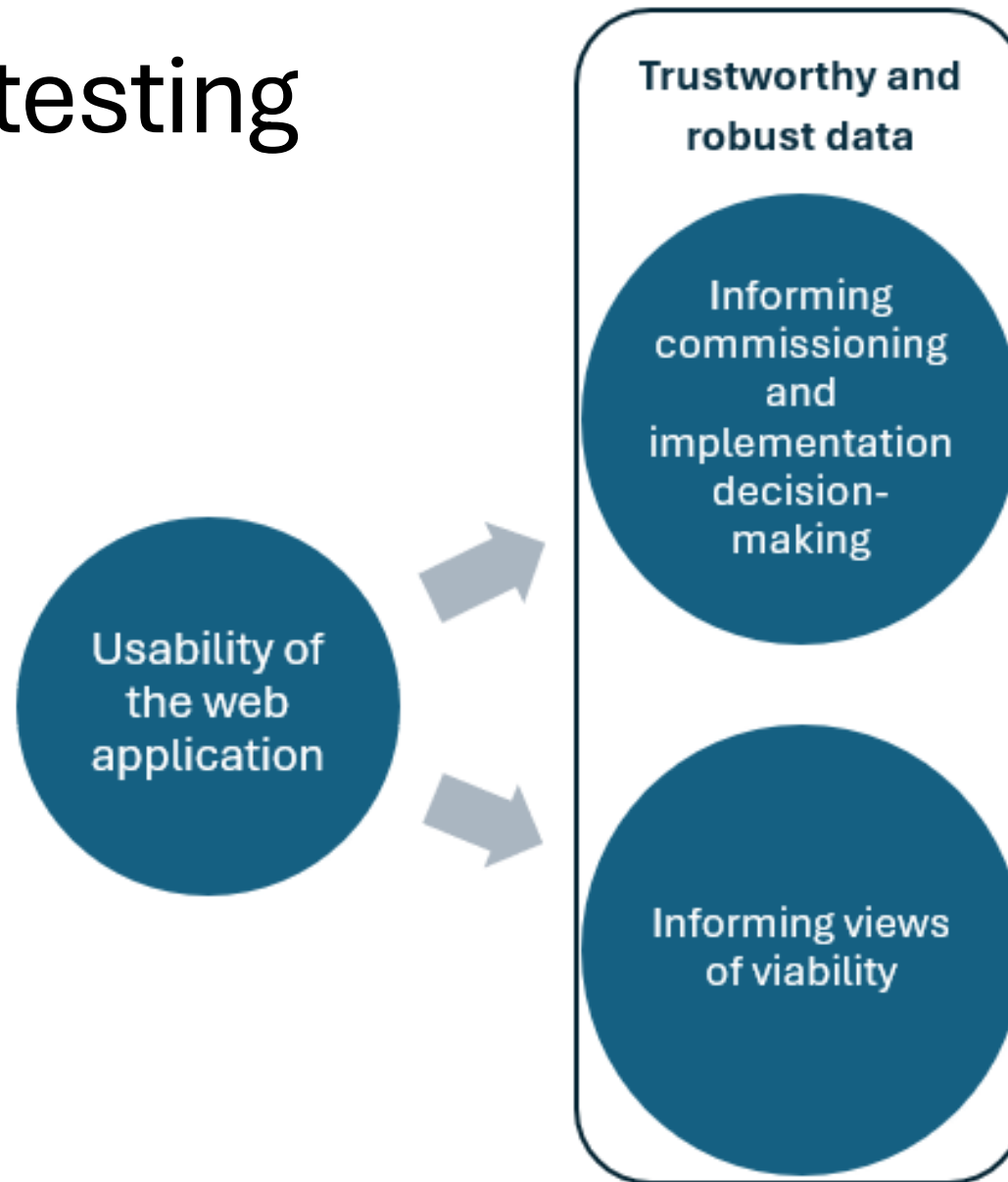


Understanding and managing(?) complexity

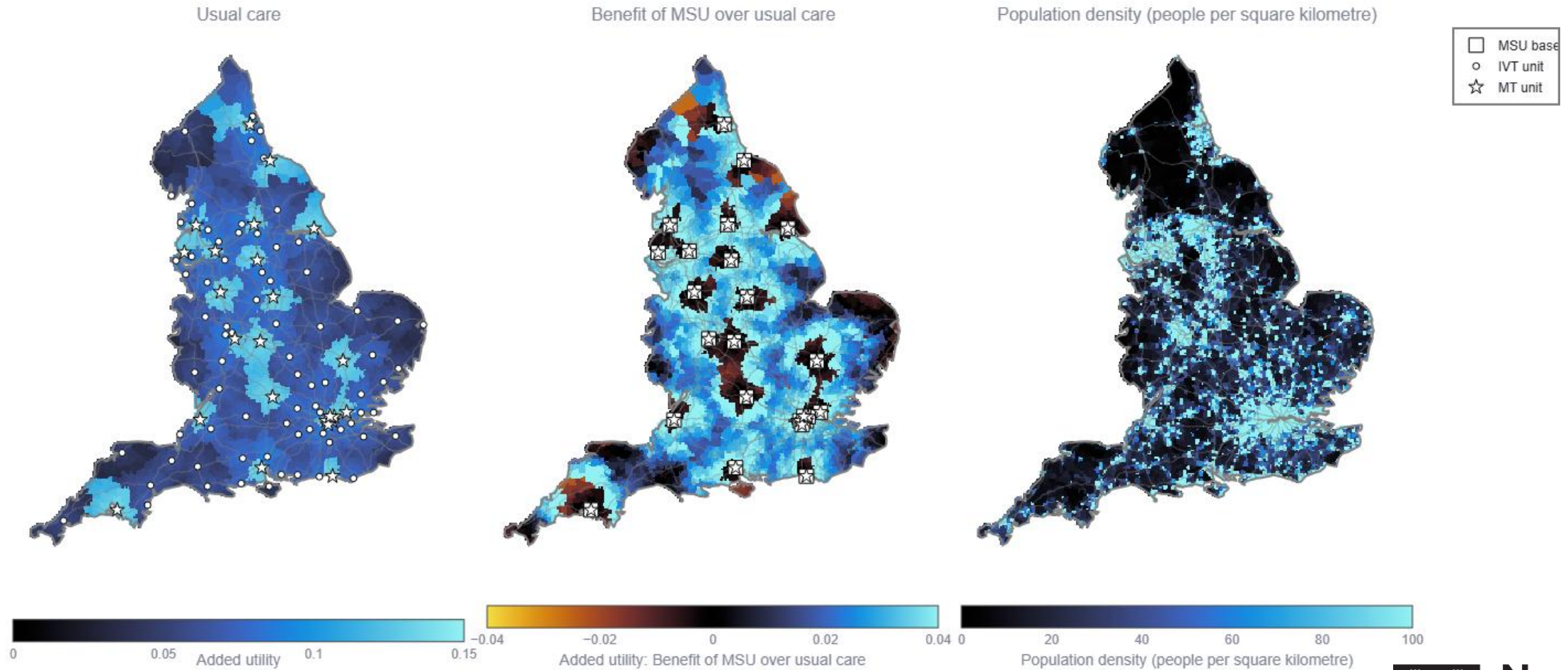


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Usability testing



Usability testing



Colour scale:

iceburn_r

seaweed

fusion

waterlily

iceburn

seaweed_r

fusion_r

waterlily_r



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Understanding commissioning

- Complex socio-technical process based on multiple priorities

“I think it’s great for the providers, it’s great for the network, and you could say it would be great on an urgent and emergency care element as well... As far as our commissioners... certainly, at the moment, there is so little emphasis on stroke anyway that just keeping stroke on the radar at all is tricky” (P5, ambulance service staff)

- Lack of role clarity in commissioning MSUs

“...I think that, for an ambulance-based resource, it would probably be for us to make the case [for MSUs], but, you know, share the data, and give the Integrated Care Boards, the commissioning bodies, access to view this to support the conversation so they could see for themselves almost the benefits from it...” (P6, ambulance service staff).



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Understanding commissioning

- Social and political challenges of commissioning; making existing services financially unviable

*“you’d get the primary stroke centres...they get a tariff don’t they for thrombolysing somebody in the primary stroke centre [ASU]. So they’d lose that and they’d lose some of their metrics for hyperacute stroke management, because in essence, you’re bypassing them to go straight to the CSC. So I think your primary stroke centres might not like [MSUs being commissioned]”
(P9, stroke or critical care physician)*

- Impact on inequitable access to stroke care and informing economic modelling of this complexity

“I don’t know the genuine numbers...but if you look at the tip of Cornwall for instance, so beyond Truro, should we place an MSU down there at the cost of £500,000 that will be used five times a week? Or should we place two MSUs in the middle of Plymouth that will cost £1m in total but be used 20 times a week? The former gives you equity of access to the MSU. The latter gives you volume of patients and the number needed to treat for mechanical thrombectomy” (P14, stroke or critical care physician).



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In conclusion...

- Agile processes and co-production in the development of a web application allowed us to develop and present usable models on the effectiveness of MSUs within the English NHS.
- Produced empirical evidence in support of developing innovative and accessible digital dissemination tools to inform commissioning processes.
- The web application allowed us to better understand complexity in both the research process and commissioning

Acknowledgements

Thank you to all participants for their time

The whole study team (particularly Peter McMeekin, Co-PI and economics workstream lead & Mike Allen, quantitative workstream lead)

This study/project is funded by the NIHR Health and Social Care Delivery Research: NIHR153982; <https://fundingawards.nihr.ac.uk/award/NIHR153982>. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care

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An AM-SMART Platform for non-expert use of computational methods for data exploration

Professor of Sociology

Director, Wolfson Research Institute for Health & Wellbeing

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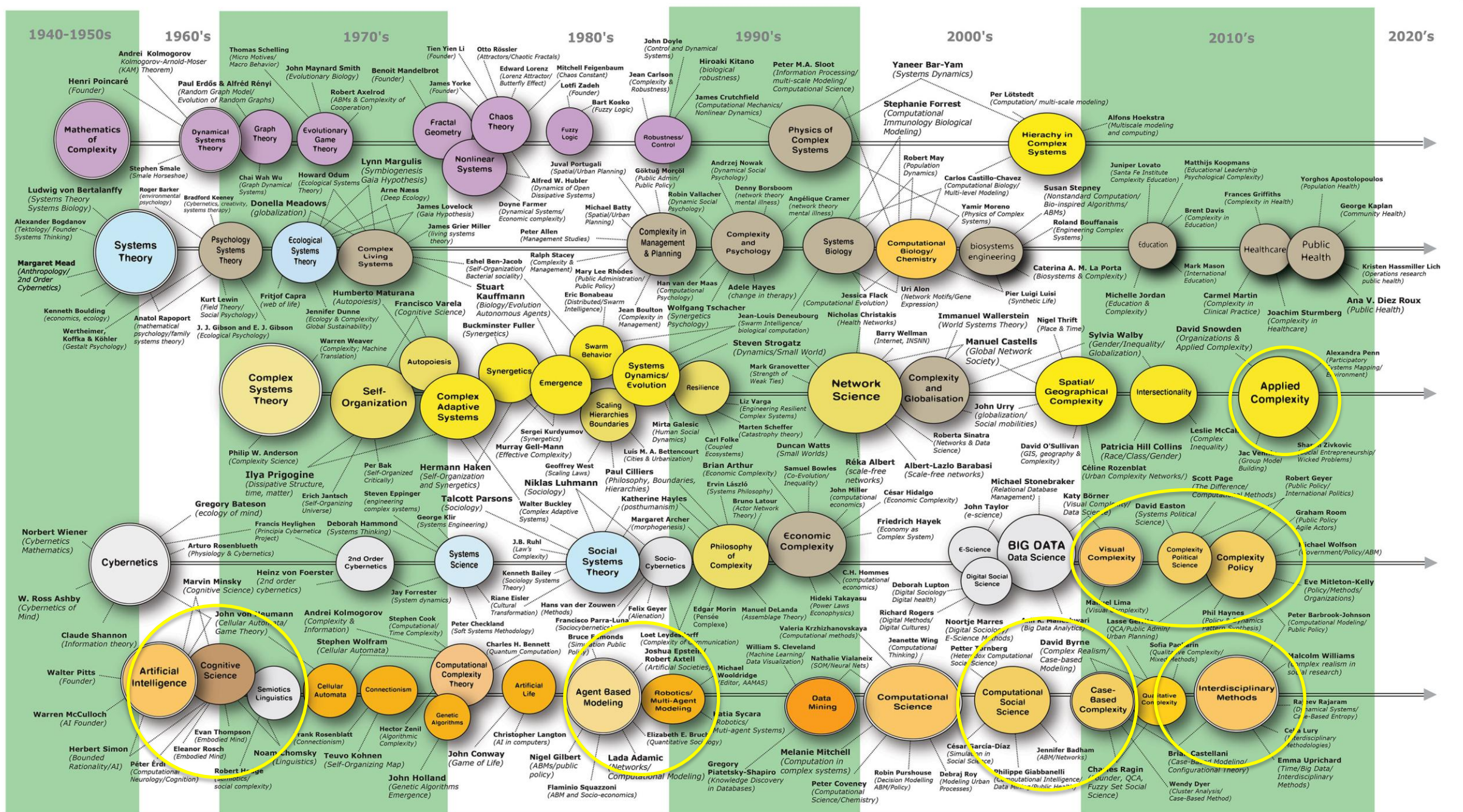
The Field of Case-Based Complexity

Case-based complexity is a suite of interdisciplinary methods first advanced by David Byrne and colleagues as an improvement on the conventions of cased-based qualitative configurational analysis (QCA).

While marginal to mainstream computational methods, case-based complexity is an established field of study, particularly in sociology, policy studies, political science, governance, urban planning and public administration.

Case-based complexity is grounded on Byrne's novel insight that cases meet the definitional critique of complex systems.

An excellent introduction to this methodology is Byrne and Ragin's *Sage handbook of case-based methods*.



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Build Your Model

1. Build database and import your cases

2. Cluster your cases

Confirm & Explore Your Model

3. Use AI to confirm your cluster solution

4. Compare and visualize your results

Run Scenario Simulations

5. Simulate your scenarios, policies, and interventions

Run Data-forecasting/classification

6. Use AI to predict the cluster membership of new cases

Systems Mapping Tab

7. Using Systems Mapping To Explore Cluster Variables

Export Your Results

8. Generate your report

[Help](#)

Select the number of clusters

3

Do you want to set a seed for reproducible results?

Fuel.poverty	Social.Isolation	Get.NHS.Health.check
10.091	45.233	32.759
11.614	48.155	30.53
10.646	45.562	37.842
10.567	45.854	34.402

```
(x = km@uclusters, dist = dissM)
3 clusters Cj
j: nj | ave(Cj) Sj
```

1 : 57 | 0.41

2 : 22 | 0.41

COMPLEX-IT

Team

As a team we are committed to advancing a **case-based complexity approach** to research, policy and practice in an effort to advance the study of social complexity and to support decision making. We each bring to the team a wide range of methodological and programming expertise and are proud of the truly transdisciplinary and international makeup of our work.



Brian Castellani
Durham Research Methods Centre
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Corey Schimpf
Department of Engineering Education
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Peter Barbrook-Johnson
School of Geography and the Environment
Oxford University



Michael Ball
Computer Services
Kent State University, Ashtabula



Christopher Caden
Durham Research Methods Centre
Durham University



COMPLEX-IT is part of the AM-Smart movement in methods

- Advances in the integration of smart technology with interdisciplinary methods has created a new genre, **approachable modelling and smart methods** – AM-Smart for short.
- AM-Smart platforms address a major challenge for applied and public sector analysts, educators and those trained in traditional methods: accessing the latest advances in interdisciplinary (particularly computational) methods.
- AM-Smart platforms do so through nine design features. They are
 - (1) bespoke tools that
 - (2) involve a single or small network of interrelated (mostly computational) methods
 - (3) they also embed distributed expertise
 - (4) scaffold methods use
 - (5) provide rapid and formative feedback
 - (6) leverage visual reasoning
 - (7) enable productive failure
 - (8) promote user-driven inquiry
 - (9) while counting as rigorous and reliable tools

COMPLEX-IT is a case-based, mixed-methods platform for applied social inquiry to complex data/systems, designed to increase non-expert access to the tools of computational social science.

Presently, the platform is comprised of a bespoke suite of techniques, including:

1. cluster analysis
2. artificial intelligence
3. data visualization
4. data forecasting
5. case-based systems mapping
6. case-based scenario simulation

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```
(x = km@uclusters, dist = dissM)
```

3 clusters C_j
 $j: n_j | \text{ave}_{i \in C_j} s_i$

1: 57 | 0.41

2: 22 | 0.41

Managing complexity: Questions, answers and experiences

Consider work you are or have been involved in and what were your greatest challenges in managing complexity

- How have you managed (or struggled) with complexity?
- How might new tools (such as digital web applications and/or COMPLEX-IT) help overcome challenges?
- What are the barriers to using tools?
- How else might we manage complexity?



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