

Connecting research and health systems for place-based transformation: the development of the NIHR Applied Research Collaboration Wessex infrastructure

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Abstract

Background

Applied research and health and care systems are often insufficiently connected: research priorities and outputs may not align with system and community needs, while the relationships and capabilities required to interpret and act on evidence may be underdeveloped. This study examines how a regional applied research infrastructure was designed to support continuous reciprocal learning, align research with place-based challenges and develop conditions for implementation.

Methods

A theory-informed, practice-based case analysis examined the development of the National Institute for Health and Care Research Applied Research Collaboration Wessex, a regional applied research infrastructure in southern England, from priority setting in 2024 to the establishment and initial operation of its 2026–2031 infrastructure in 2026. Documentary evidence and practitioner reflection were analysed chronologically and interpretively to reconstruct design requirements, decisions, relationships and intended mechanisms.

Results

Successive design phases produced an architecture linking four networks: place-based health and care systems, academic communities, research infrastructures and problem-oriented knowledge networks organised around defined challenges. A Collaboration Hub coordinates six shared capabilities; challenge-led Flagships provide enduring contexts for joint problem definition, research and implementation preparation; and a common Participation Pathway supports inclusive participation, readiness assessment and implementation preparation. The architecture incorporates continuous learning between research, practice and communities as an operating requirement across the research lifecycle.

Conclusions

The Wessex experience provides an account of how partnership, knowledge-mobilisation and implementation functions can be configured as a continuing infrastructure through which research and health and care systems shape one another. The paper contributes a prospective design account of this infrastructure and its intended mechanisms. Its effects on research–system alignment, equitable participation, implementation, learning and population impact require subsequent evaluation.

Background

The practical problem

Persistent health and care challenges cross organisational, professional and disciplinary boundaries. Improving outcomes for people living with multiple long-term conditions, preventing avoidable illness and supporting care at home require research evidence, practical and lived knowledge, community participation and coordinated action. Research-production and implementation contexts are often weakly connected: research questions and outputs may not reflect operational priorities or constraints, while health and care systems may lack the relationships or shared language needed to interpret and act on evidence [1, 2]. Organisational readiness depends on collective commitment, capability, motivation and fit with the proposed change [3–5], while implementation is shaped by the complexity of organisational and social context [6].

The problem is therefore reciprocal. Research must be shaped from the outset with the people, communities and organisations concerned, while participating systems must develop the conditions through which evidence can inform decisions and change. Research questions, methods, communications and participation routes can create barriers to diverse involvement when accessibility and inclusion are insufficiently considered in their design. Co-production, inclusive design, brokerage, workforce development and continuing feedback are therefore part of the infrastructure through which useful knowledge is generated and mobilised.

Current National Health Service (NHS) policy in England identifies shifts from hospital to community, analogue to digital and sickness to prevention [7]. Neighbourhood health guidance places integrated care boards, local authorities, health and social care providers and communities at the centre of services delivered closer to home [8]. These settings involve distributed responsibilities, informal care, unequal resources and substantial variation between places. Research supporting these shifts must therefore connect with the wider systems through which care is organised and experienced, while addressing the needs of underserved populations and inequalities in health and its social determinants [9].

In England, the National Institute for Health and Care Research (NIHR) funds Applied Research Collaborations (ARCs) to produce applied health and care research, strengthen research capacity, involve patients and communities and support implementation. Funding guidance requires ARCs to organise research around defined areas of health and care while also providing capabilities including research inclusion, public involvement, research capacity development, implementation and knowledge mobilisation [10]. This creates an organisational design question: *how can these functions operate as a persistent infrastructure through which research and place-based health and care systems continuously shape one another?*

Applied research partnerships and organisational design

ARCs developed from the NIHR Collaborations for Leadership in Applied Health Research and Care (CLAHRCs), which connected universities and health service organisations through regional partnerships. Evaluation identified shared purpose, relationships, leadership, resources, organisational

context, priority setting and boundary-spanning roles as important conditions for collective action and implementation [1, 11]. Reviews nevertheless found persistent professional boundaries, competing institutional priorities, different timescales and separation between research production and use [2].

Research on boundary spanning, collaborative networks and place-based research emphasises brokerage, trust, integration of different forms of knowledge and sustained organisational effort [12–14]. The unresolved operational question is how to organise these conditions across a portfolio so that system and community priorities shape research, partners can access expertise and implementation learning informs subsequent decisions.

These findings frame applied research partnerships as an organisational design problem involving the coordination of multiple functions and independently governed organisations across research, implementation and learning.

System readiness and implementation

Organisational readiness concerns collective commitment to change and confidence in the capability to achieve it [3, 4]. Motivation, general organisational capacity and innovation-specific capacity provide complementary dimensions [5]. Readiness extends across the research and implementation context. It depends on whether an intervention or body of evidence is sufficiently relevant, mature, evidenced, usable and aligned with the setting in which change is proposed.

Implementation depends on the work required to integrate new practices into particular organisational and social settings. Normalisation Process Theory draws attention to collective work, while subsequent research highlights contextual complexity [6, 15]. Workforce capability, workload, staffing, professional judgement and organisational priorities can enable or constrain this work even where research and implementation support are available.

For regional applied research, readiness is often inter-organisational. Studies across primary care and wider health-system settings show that readiness often depends on relationships and coordination across multiple organisations, professions and community actors [16–18]. System readiness therefore comprises the relational, organisational and practical conditions through which relevant actors recognise a shared challenge, shape useful research, coordinate action and learn from implementation.

Learning health systems and enabling environments

Learning health systems seek to generate knowledge from practice, apply knowledge to improvement and use feedback to support further learning [19]. Enabling conditions include shared values, relational culture, leadership, participation, organisational support, data, technical services, governance and human capability [20–23]. Relational culture concerns how different forms of knowledge are valued, how openly

decisions and constraints are communicated, and how trust and disagreement are handled through continuing collaboration.

Continuous reciprocal learning connects infrastructure design with learning-system development. An enabling environment must support the production of relevant knowledge, feedback from its application, and the relationships, authority, workforce and resources needed to interpret and use it. Learning can produce value through implementation, but also through better decisions, new insights, capability development, stronger relationships, methodological advances and changes to policy or future research priorities.

Problem-oriented knowledge networks, participation and leadership

Knowledge mobilisation involves relational and boundary-spanning work through which research, practical and lived knowledge are connected across organisations and communities [11–13]. Place-based health and care, academic and research-infrastructure networks have distinct purposes and institutional relationships. A problem-oriented knowledge network brings together people, organisations, expertise and resources across these established networks to define and address a shared challenge.

Participation includes involvement in research and in the problem-oriented networks through which challenges, priorities and projects develop. Research infrastructure is relational: access depends on how technologies, practices, conventions and organisational arrangements become embedded and available to different users [24]. Participation provides meaningful influence only when unequal resources and power are recognised and addressed [25, 26]. Inclusive research therefore concerns who participates in, designs and conducts research and whose knowledge shapes priorities, governance and learning. Researchers contribute through disciplinary expertise, institutional roles and knowledge of local contexts.

Institutional authority, resources, professional status and established research practices can privilege researchers and organisations and constrain the influence of public contributors [25]. Public contributors, community leaders, practitioners, researchers, brokers and system-based change makers connect institutions and advance work. Trust, facilitation, leadership and workforce development are needed to support their influence [1, 12–14, 20].

Existing precedents and design influences

Bristol Health Integration Teams provide a health-sector precedent by connecting NHS organisations, universities, local authorities, patients and the public around defined priorities [27, 28]. CLAHRCs and ARCs provide wider experience of regional partnership, boundary spanning, public involvement, knowledge mobilisation and implementation [1, 2, 10–13]. These precedents informed the Wessex design while also demonstrating the continuing challenge of coordinating functions across portfolios and institutional boundaries.

Experience from European Future Internet Research and Experimentation initiatives also influenced the design. Fed4FIRE and related programmes federated separately owned research facilities through a common framework and shared tools for accessing and using participating testbeds [29]. The transferable lesson is how independently governed organisations can operate as a connected research infrastructure. In health and care, this coordination must also address ethical, relational, professional, governance and public-accountability requirements.

Study aim and research questions

This study examines how NIHR ARC Wessex developed an applied research infrastructure intended to align research with place-based health and care challenges, support reciprocal learning and develop the conditions required for implementation.

The analysis addresses three questions: (1) how did regional priorities, stakeholder requirements and successive programme decisions shape the infrastructure; (2) what architecture and operating mechanisms emerged to connect collaborators, research themes, shared capabilities and challenge-led Flagship programmes organised around defined population and health or care system challenges; and (3) what transferable propositions arise for research–system alignment, participation, readiness, coordination across research infrastructures and learning?

The resulting prospective account establishes a baseline for future empirical evaluation of the architecture’s implementation and contribution to health and care system transformation and population impact.

Methods

Study design and setting

This theory-informed, practice-based case analysis examines the design and early development of NIHR ARC Wessex for 2026–2031. Documentary evidence and structured practitioner reflection were used to reconstruct how requirements, decisions and activities shaped the operating architecture from regional priority setting in 2024 to the establishment and initial operation of Flagship programmes, including public review, in 2026.

The infrastructure comprises five research themes, five challenge-led Flagship programmes, the Collaboration Hub, the Participation Pathway and relationships with health and social care organisations, local authorities, people and communities, voluntary organisations, industry and other research infrastructures across Dorset, Hampshire and the Isle of Wight.

Design process and sources

The design developed iteratively between 2024 and 2026. Engagement with regional partners identified priority areas for research and the need for clearer access to the ARC, stronger relationships, inclusive

participation, knowledge mobilisation, data capabilities and implementation support. These findings progressively informed programme development, funder review, mobilisation workshops, the regional research-inclusion event, the first General Assembly and the establishment of Flagship programmes, shaping the structures and processes through which the ARC operates.

Documentary sources included the 2024 regional stakeholder review and underlying strengths, weaknesses, opportunities and threats (SWOT) material; stakeholder records; the earlier knowledge-mobilisation capacity-building application and monitoring records; funding applications; strategic and operational plans; architecture diagrams and presentations; workshop materials; General Assembly records; research-inclusion materials; Flagship formation reports; plain-English summaries; and People's Council review materials. Sources were classified as records of completed activity, organisational commitments or proposed future arrangements.

Documents were reviewed systematically, including in date order, to identify the requirements, decisions and changes that shaped the infrastructure [30]. Authors involved in programme design and early operation reflected on why particular decisions were made and how experience from other fields influenced the design. These interpretations were checked against records produced at the time.

The main developmental phases are summarised in Table 1. A detailed internal evidence register was maintained to support governance, verification and subsequent evaluation.

Table 1
Development chronology and documentary basis.

Period	Stage	Documented development
Early 2024	Regional priority setting	ARC Wessex and Wessex Health Partners stakeholder review; documented system requirements, organisational priorities, public involvement and emerging research themes.
May 2024–Mar 2025	Knowledge mobilisation capacity-building	Submitted capacity-building application; national funding announcement; initial fellows and programme management; mental health and community-based care priorities.
May–June 2025	Strategic programme design	Development of Flagships, agile research activity, the Collaboration Hub, five research themes and initial governance.
Nov 2025–Mar 2026	Pre-launch mobilisation	Launch planning; governance, finance, Hub and thematic-programme workshops; workforce and operational planning.
26 March 2026	Research inclusion co-production	Regional appreciative-inquiry event involving 31 participants; development of a shared Research Inclusion Vision and priorities for community relationships, participation and accessibility.
Spring–2 Jun 2026	Enterprise architecture and General Assembly	System-partner discussions; architecture presentation; Flagship outlines; integrated Hub responses and Assembly discussion.
Jun–Aug 2026	System-partner integration	Involvement of Hampshire and Isle of Wight and Dorset system representatives in knowledge mobilisation and Flagship development.
20 Jul–6 Aug 2026	Flagship formation	Four care-focused workshops; population and system mapping; cross-theme input; formation reports and governance preparation.
2–9 Sep 2026	People's Council review	Plain-English Flagship summaries; affected populations; structured public feedback; inclusion, missing perspectives and readiness.

Analytical approach

The analysis used two complementary perspectives. A network view examined relationships among three established network types: place-based health and care networks, academic networks and research-infrastructure networks. An architectural view examined how activity was organised across four layers: place, collaboration, transformation and research. The analysis then traced how Flagships connected selected actors, knowledge and capabilities across these networks and layers to form problem-oriented knowledge networks. Attention was given to priority setting, participation, relationship development, access to expertise, readiness, feedback and learning.

Research on research–practice partnerships, knowledge mobilisation, learning health systems, readiness, implementation and federated research infrastructure informed interpretation. The analysis identifies what has been implemented, its intended mechanisms and lessons for other settings.

Use of generative artificial intelligence

OpenAI ChatGPT was used during manuscript preparation to organise and compare documentary sources produced between 2024 and 2026 that underpinned the design, and to provide grammar and language editing. All outputs were checked against the source documents and reviewed by the authors who take full responsibility for the final content.

Results

The analysis describes how ARC Wessex developed an infrastructure connecting research with place-based health and care systems and communities around shared health and care challenges.

An infrastructure architecture for place-based system transformation

Enterprise architecture describes how an organisation's purposes, people, processes, information, capabilities and technologies fit together. ARC Wessex applies this approach across four connected layers: place, collaboration, transformation and research.

The place layer concerns the populations, communities, care settings and institutions associated with a health or care challenge. The collaboration layer provides the relationships, participation routes and shared capabilities through which people and organisations work together. The transformation layer comprises Flagship programmes that coordinate sustained activity around defined population and health or care system challenges. The research layer comprises the thematic communities and projects through which knowledge and interventions are developed.

The network types operate across these layers. Place-based health and care networks organise services and community relationships; academic networks connect researchers, universities and disciplinary communities; and research-infrastructure networks provide complementary capabilities. Each retains its own purposes, relationships and governance. A Flagship brings relevant actors, knowledge and capabilities from these networks together around a defined challenge, forming a problem-oriented knowledge network. The Collaboration Hub, Participation Pathway and research themes support its development and continuing activity. Figure 1 shows these relationships.

From regional requirements to an operating architecture

The infrastructure developed through regional engagement, strategic programme design, mobilisation and co-production between 2024 and 2026. Wessex Health Partners (WHP) provided an established regional partnership connecting universities, NHS organisations and wider research and innovation partners. During early 2024, ARC Wessex and WHP undertook a regional review, including a SWOT analysis, involving NHS organisations, integrated care boards, local authorities, universities, research infrastructures, voluntary organisations and public contributors across Dorset, Hampshire and the Isle of

Wight. The review identified research priorities and requirements concerning the visibility of the ARC offer, relationships across organisations, access to data, research inclusion, knowledge mobilisation and the adoption of research within health and care systems. These requirements informed the subsequent funding proposal and programme development.

Knowledge mobilisation capacity also developed through an NIHR-funded capacity-building programme established before the 2026 ARC funding period [31]. Wessex identified mental health and community, residential and domiciliary care as initial priorities given these areas had been under-represented in research undertaken previously. It proposed closer connections between research, health and care organisations and system-improvement teams. This funded capability continued into the new ARC and was integrated into the Collaboration Hub and Flagship operating model.

During bid preparation in 2025, the programme adopted a dual portfolio of challenge-led Flagships and agile research activity. The dual portfolio was chosen to sustain long-term work on defined challenges while retaining capacity to respond to emerging opportunities. The design connected research themes, a Collaboration Hub and shared capabilities through a common operating model. Pre-launch workshops developed relationships between these components, organisational responsibilities and arrangements for programme mobilisation.

An enterprise architecture presented at the first General Assembly in June 2026 made the proposed institutional relationships and operating arrangements explicit. Subsequent engagement refined the collaborator taxonomy, place-based framing and Participation Pathway. Flagship workshops then applied the architecture to population needs, system relationships, research capabilities and preparation for implementation.

These requirements led to five linked design decisions. Research themes were retained to sustain disciplinary expertise; Flagships were created to sustain relationships, shared priorities and preparation for implementation around defined system challenges across successive projects; shared capabilities were brought into a Collaboration Hub to provide consistent access and reduce duplication; the Participation Pathway was developed to make routes into research visible and address barriers systematically; and institutional interfaces were defined so that independently governed organisations could coordinate without centralising ownership.

Collaborators in place-based health and care networks

The architecture identifies seven collaborator groups whose continuing involvement develops these priorities: Individuals and Families; Community Groups; Community Organisations; Industry; Service Providers; System Leaders; and Policymakers.

Individuals and Families, Community Groups and Community Organisations play a central role in defining the challenges, research questions and outcomes that matter. They contribute lived experience of conditions and care pathways, knowledge of local priorities and assets, trusted relationships, and

understanding of participation barriers and inequalities. Their involvement provides a foundation for community-led research and shapes how Flagship programmes develop.

Service Providers contribute knowledge of care delivery, workforce constraints and operational responsibilities. System Leaders and Policymakers connect research with commissioning, population priorities, institutional decisions and opportunities for health and care system transformation.

Industry contributes products, services, technologies, innovation capability and knowledge of the conditions required for adoption. Its involvement connects these capabilities with defined Flagship priorities, relevant populations and the organisations responsible for implementation. The Wessex funded agile research programme provides a route for developing emerging opportunities and connecting industry and other collaborators with system challenges.

Interaction across these collaborator groups develops and refines priorities relating to access to care, prevention, community participation, workforce capacity, data availability and implementation. The infrastructure connects these priorities with relevant populations, places and Flagship challenges as system needs, knowledge and opportunities develop. Figure 2 summarises the collaborator groups and their different priorities and contributions.

The Collaboration Hub and shared operational capabilities

The Collaboration Hub provides the organisational mechanism for forming and maintaining problem-oriented knowledge networks around health and care challenges. It connects system partners, communities, Flagships, research themes and specialist capabilities through shared infrastructure. It also provides a route into the ARC for health and care partners and coordinates navigation, relationship development, participation, connections with relevant expertise and implementation planning across the research portfolio.

Research Inclusion and Community Engagement form a shared capability supporting inclusive and participatory research. Research inclusion identifies and addresses barriers affecting who can participate in, design and conduct research. Community engagement develops and sustains relationships with Community Groups and Community Organisations, including those insufficiently connected with research. Patient and public involvement and engagement (PPIE) provides defined roles and processes through which patients, service users, carers and members of the public influence research priorities, design, conduct, governance and communication. PPIE sits within the shared Research Inclusion and Community Engagement capability so that established involvement practice connects with wider community relationships and work to remove barriers to participation.

Co-production is being developed as a cross-cutting working principle, informed by NIHR guidance, through which researchers, practitioners and members of the public work together and share power and responsibility in shaping research and generating knowledge [32]. Within ARC Wessex, this means involving people and communities early, agreeing which decisions will be jointly owned, supporting

accessible participation and showing how contributions influence decisions. Its application will be refined with system and community partners and tested through Flagship design. Research capacity development supports the workforce capabilities needed for participation, applied research and learning, while knowledge mobilisation connects research evidence with professional experience, lived experience, local intelligence and policy priorities.

Methods, analytics and economics provide access to study design, evaluation, population analysis and consideration of costs and system learning. Implementation support contributes understanding of adoption, service improvement, operational constraints and opportunities for scaling. Collaboration management connects and records relationships between people, organisations, opportunities, activities, projects, outputs and impacts.

Expertise remains distributed across participating institutions and research communities. The Hub provides a route for health and care partners to identify and connect with some of this expertise and coordinates contributions around Flagship programme challenges. Its coverage and effectiveness will develop as more collaborators, capabilities and relationships are recorded and used.

The Participation Pathway and reciprocal learning

The Participation Pathway provides a common operating process through which people, communities and organisations engage with the infrastructure. Its six stages are discover collaborators, build relationships, assess readiness, enable participation, connect to research and capture learning.

Discovery identifies the population, place, care pathways, organisations, community assets and existing relationships. Relationship development connects researchers with people who hold operational responsibility, lived experience, community trust or authority to influence change and must bridge different organisational and community cultures. Readiness assessment then considers institutional commitment, relationships between organisations, workforce capability, community trust, data access, research experience and implementation responsibilities, identifying barriers or missing support.

Participation support connects collaborators with the relevant shared capabilities, including inclusive methods and communication, workforce development, knowledge mobilisation, population analysis, study design and implementation support. Connection to research links collaborators with Flagships, themes and project opportunities. Learning capture records participation, relationships and implementation conditions. The pathway is iterative, allowing collaborators to enter at different stages or return as a Flagship develops (Fig. 3).

Flagship programmes as contexts for system preparation, implementation and scaling

The Flagship programmes (Flagships) organise activity around Obesity across the Lifecourse, Tackling Addiction in Communities, Tackling Challenges in Multiple Long-Term Conditions, Dementia Care at

Home and Data for Care Where We Live. Each provides a continuing context for understanding a population and care-system challenge, coordinating research and developing the conditions needed for future implementation.

A Flagship is defined by the population affected, the place in which care is organised, the relevant institutions and community relationships, and the change being pursued. Individual research projects contribute within this wider context. The Flagship provides continuity across projects so that implementation responsibilities, institutional relationships and learning can develop over time.

Flagship co-production connects research teams with the organisations and communities expected to use the resulting knowledge. Joint work identifies care pathways, organisational constraints, participation barriers, relevant capabilities and potential routes to adoption. Research questions and system preparation develop through the same continuing process.

System-based leaders and change makers contribute operational knowledge, convening capability and access to decision-making. Their involvement connects Flagship development with integrated care systems, local authorities, service organisations and communities. System-partner representation within knowledge mobilisation further connects the research programme with local population intelligence and operational relationships.

The first General Assembly initiated coordinated Flagship development. Theme teams described the system challenge and intended change; Collaboration Hub functions identified participation requirements, shared dependencies and implementation questions. Subsequent care-focused Flagship workshops mapped populations, places, organisations, community relationships and capability needs. Data and Technology representatives contributed across these workshops so that technical questions were grounded in care pathways and population contexts.

The Flagship model also creates a basis for scaling. A challenge defined through population characteristics, care-system conditions and implementation requirements can be examined in other places with comparable needs. Early engagement with relevant organisations and research partners supports consideration of transfer, adaptation and wider adoption. Scaling is an intended design function; evidence of successful replication or population impact will require future evaluation.

Research themes and cross-theme working

The research themes are Healthy Communities and Prevention; Mental Health; Living Well with Long-Term Conditions; Integrated Health and Social Care; and Data and Technology. Each organises a research community, specialist expertise and project activity. Flagships draw on these capabilities according to the population, care pathway and system challenge involved.

Cross-theme working reflects dependencies between health conditions, services and implementation contexts. Dementia care at home may require expertise in long-term conditions, integrated care, mental health and digital support. Obesity prevention may involve early-life circumstances, family support,

population data and community relationships. The architecture allows these contributions to be organised around a shared challenge while themes retain their own research identity.

Data and Technology has a distinct research agenda and its own ecosystem of collaborators. Relevant relationships may include secure data environments, data and device specialists, technology providers, regulators, telecommunications and digital service organisations, and research partners developing health technologies. These actors shape how data and digital capabilities can support services delivered across communities and homes.

Data for Care Where We Live provides a dedicated Flagship context for these questions. Representatives from Data and Technology also contributed to the other Flagship workshops, connecting digital and analytical challenges with real populations, care pathways and implementation conditions.

Patient, public and community participation across infrastructure development

Patient, public and community participation contributed across regional engagement, programme design, research inclusion, mobilisation and the establishment of Flagship programmes. Early engagement included the existing ARC public involvement forum, voluntary and community organisations, and groups representing communities experiencing barriers to research participation. The programme located PPIE within Research Inclusion and Community Engagement so that inclusive design, community relationships and public influence could inform priorities, research development, implementation planning and communication.

A regional research inclusion event in March 2026 brought together public contributors, community partners, researchers, practitioners and specialists. Participants framed inclusion across the diversity of people who participate in, design and conduct research. They identified trusted community relationships, accessible participation pathways, co-design, community-led research, training, outreach and community networks as requirements for inclusive research infrastructure. This work informed the development of the Participation Pathway and identified practical conditions needed to apply the NIHR principles of co-production during Flagship design, including early involvement, inclusive participation, relationship building, appropriate support and meaningful influence over research decisions.

Public contributors participated in the General Assembly and raised concerns about digital exclusion, barriers affecting particular communities and the importance of involvement from the beginning of programme development. Flagship workshops considered affected populations, participation barriers, Community Organisations and gaps in existing relationships alongside research and implementation requirements. Public and community feedback also influenced the language and governance of the architecture, including adoption of “Community Organisations” in place of “VCFSE” and development of the People’s Council.

The People's Council provides independent public and community advice within ARC Wessex governance and reports to the Strategic Partnership Board. Its remit includes reviewing the quality and reach of involvement, engagement and participation and advising on inclusion, co-production, programme direction and implementation potential. Plain-English Flagship summaries and structured Council review provided a route for scrutiny of community priorities, affected populations, missing perspectives and opportunities for involvement. The developing ambition is for this advice, alongside wider participation by people and communities, to influence research priorities, programme decisions and preparation for implementation. Future evaluation will examine where and how that influence occurs.

Working with other research infrastructures

The architecture identifies interfaces with other research and innovation infrastructures, including Applied Research Collaborations (ARCs), Biomedical Research Centres (BRCs), HealthTech Research Centres (HRCs), the Research Delivery Network (RDN), the Research Support Service (RSS), Health Determinants Research Collaborations (HDFCs), Health Innovation Networks (HINs) and the NIHR Academy. NHS trusts, integrated care boards, local authorities, higher education institutions and wider research communities contribute additional expertise and capabilities.

Federation describes how independently governed infrastructures coordinate through defined interfaces and access arrangements while retaining their own governance, resources and responsibilities. It depends on making capabilities visible, clarifying how they can be accessed and agreeing how participating organisations will coordinate.

Federation can connect ARCs working on shared challenges, comparable populations, adaptation across places and scaling. It can also connect other types of research infrastructure across discovery, applied research, evaluation, implementation and innovation. Health Innovation Wessex provides complementary expertise and relationships supporting innovation adoption and spread. Federation can connect applied research, evidence development and system preparation with routes to wider adoption.

Flagships help identify which external capabilities are relevant, while the Collaboration Hub connects partners with them. These arrangements provide a foundation for wider federation, adaptation and scaling as research programmes and policy priorities develop.

Collaboration management and learning

A Collaboration Management System has been established to track infrastructure activity through connected records for Collaborators, Opportunities, Projects and Activities, Outputs and Impacts. Designed around the ARC Wessex architecture and managed by the Collaboration Hub, the system provides a shared record of the problem-oriented knowledge networks through which system challenges are defined, research is organised and implementation opportunities are developed.

The Hub uses the system when collaborators make contact, helping identify relevant expertise, existing relationships and routes into the infrastructure. Access can also arise through Flagships, research themes, partner organisations and community relationships. Research teams and Flagship leads use the same system to track activity across the portfolio. Recording enquiries, referrals and decisions helps identify where access is delayed, redirected or lost. Transparent routes and feedback to collaborators help reduce the risk of gatekeeping.

Capturing these relationships creates a basis for collaborative learning and evaluation. As Flagships develop, the system can show how knowledge networks form, which organisations and communities participate, how research activities connect with system priorities and where further engagement is needed. This provides infrastructure for examining how collaboration contributes to system readiness, implementation and longer-term change.

Discussion

ARC Wessex has developed and begun operating an applied research infrastructure through which research, health and care systems and communities can shape one another through continuing collaboration and learning. The paper's principal contribution is an account of how challenge-led programmes, shared capabilities, a participation process and relationships between organisations were configured within a common operating architecture.

The architecture depends on the work involved in building and maintaining relationships and on the culture this creates. ARC Wessex has used repeated engagement, shared design, transparent documentation and continuing dialogue to bring different perspectives into programme development. Trust and collective ownership develop through these practices over time, requiring continuing investment, facilitation and leadership.

Research–system alignment and readiness develop through sustained relationships among researchers, communities and health and care organisations [1–5, 16–18]. Research questions, interventions and delivery models need to be relevant and usable, while participants require the authority, workforce capability and resources to engage with research and act on emerging knowledge [3–6, 15]. Connecting priority setting, co-production, research development, implementation preparation and feedback distributes responsibility across research and implementation contexts and supports learning through implementation, stronger partnerships, workforce development and better decisions [1, 11, 19–23].

Flagship programmes provide continuing contexts in which populations, care pathways, organisations and research questions can be considered across successive projects. Building on evidence about boundary spanning and partnership development [12, 13, 18], the four-network interpretation developed in this study explains how place-based health and care, academic and research-infrastructure networks contribute to problem-oriented knowledge networks around each challenge. The Collaboration Hub connects participants and relevant expertise, the Participation Pathway provides a common process for

involvement and learning, and the Collaboration Management System retains evidence about relationships and activity.

Organising capabilities as shared infrastructure enables knowledge, relationships and specialist support to be sustained and used across Flagships and projects. This reduces duplication, makes expertise held across partner organisations more visible and preserves capacity for learning. Connecting these functions through a continuing operating model allows learning from participation, research development and implementation to inform subsequent activity.

ARC Wessex treats equity as a design property because reciprocal learning depends on who can participate, design and conduct research and whose knowledge influences priorities and decisions [10, 25, 26]. This requirement has informed the Participation Pathway, the positioning of PPIE within Research Inclusion and Community Engagement, the use of Community Groups and Community Organisations, the People's Council, and attention to accessibility, training and practical barriers. These arrangements create routes for contribution, although their effect on equitable influence remains to be evaluated. Evaluation will examine whose knowledge reaches decisions, how it affects research and implementation, whether participation becomes more diverse and influential, and how learning is returned to participants.

Links with industry and other research infrastructures connect additional expertise, resources and routes to implementation. Their contribution is assessed against population need, public benefit and the requirements of the Flagship challenge. Agreed routes for access and coordination allow independently governed organisations to collaborate and scale activity while retaining their own governance, resources and responsibilities [21, 24, 29].

The configuration of research themes, Flagship priorities and institutional relationships reflects the Wessex context. The transferable contribution lies in the design principles: sustained work around shared challenges, defined interfaces among established networks, common participation and capability processes, and continuity of relationships and learning across projects. Application elsewhere would adapt these principles to local populations, institutions and governance.

The practical implication for funders and research leaders is to assess infrastructure through the projects it funds and the connections it creates among research production, system priorities and learning. Organisations developing similar infrastructure should begin with challenges defined with relevant people, communities and system partners; establish clear routes for collaborators to participate and influence research; organise expertise across programmes; support data stewardship; agree how organisations will coordinate; and retain evidence about relationships, activity and implementation.

ARC Wessex now has a route for health and care partners, operating capability teams, Flagships and a Collaboration Management System. The next phase applies this infrastructure through Flagship co-production and delivery, with evaluation focused on whether problem-oriented knowledge networks contribute to readiness, adoption, learning and population benefit.

Strengths and limitations

A strength of the study is its contemporaneous documentary trail spanning regional priority setting, programme development, mobilisation, and the establishment and initial operation of Flagship programmes. Reporting during early implementation increases transparency and provides a baseline before outcomes are known. The analysis also combines organisational architecture with established partnership, implementation and learning-system literatures.

The account is predominantly produced by people involved in the programme and may privilege the intended design over alternative interpretations. Documentary coverage and participation varied between activities, and the paper does not establish causal effects or improved outcomes. Public, community and external-system perspectives require stronger representation in subsequent evaluation. The architecture is in early operation, while its mechanisms and effects remain context dependent and require empirical evaluation.

Future research

Future research will develop through three linked stages. This paper documents the development and establishment of the ARC Wessex operating architecture, including the requirements, decisions and design propositions that shaped it. The next stage will evaluate how the architecture is applied during Flagship design and early programme delivery. Subsequent research will examine the contribution of the resulting research activity and problem-oriented knowledge networks to health and care system change, population benefit and socioeconomic impact.

The design and implementation evaluation will use a longitudinal mixed-methods approach. Problem-oriented knowledge networks will provide the principal unit through which infrastructure activity is studied. Each network will be grounded in a defined population and health or care system challenge and will connect the people, communities, organisations, research capabilities, projects and implementation contexts relevant to that challenge.

The evaluation will address the following research questions:

1. How does the infrastructure identify and address barriers to equitable participation in research, including who participates in, designs and conducts research, how their contributions influence priorities and decisions, and what can be learned from attempts to remove those barriers?
2. How are system-defined health and care challenges translated into problem-oriented knowledge networks, research questions, projects and implementation activity?
3. How do these networks and the wider infrastructure support reciprocal learning, research and system readiness, and preparation for implementation?

The Collaboration Management System will provide longitudinal and relational evidence linking Collaborators, Opportunities, Projects and Activities, Outputs and Impacts. It will show how networks form, how opportunities develop into research activity, who participates, which sectors and places are represented, where relationships are sustained or lost, and how outputs emerge. Interviews, observations, documentary analysis and comparative Flagship case studies will examine participants' experiences and the mechanisms, power relationships, trust, transparency, whose knowledge influences decisions and contextual conditions underlying these patterns.

A later impact evaluation will follow selected problem-oriented knowledge networks and associated research and implementation activities, examining contributions to services, policy, practice, workforce capability, population outcomes and resource use. It will also develop a framework for assessing value and return on investment in a continuously learning infrastructure, covering research outputs and implementation outcomes alongside changes in relationships, capability, coordination, decision-making and the reuse of learning.

Conclusions

ARC Wessex has developed an applied research infrastructure connecting research with place-based health and care challenges through reciprocal learning. It brings together four network types through Flagship programmes, research themes, a Collaboration Hub, a Participation Pathway and links with wider research infrastructures. The model enables communities, health and care systems and researchers to define questions, sustain relationships and capabilities across projects, and use research and implementation experience to guide subsequent decisions.

The architecture offers a transferable approach to coordinating independently governed organisations around shared health and care challenges. ARC Wessex is now applying this approach through Flagship co-production and programme delivery. Future evaluation will examine how the resulting problem-oriented knowledge networks support equitable participation, reciprocal learning, implementation, health and care system transformation and population benefit.

Abbreviations

ARC

Applied Research Collaboration

BRC

Biomedical Research Centre

CLAHRC

Collaboration for Leadership in Applied Health Research and Care

FIRE

Future Internet Research and Experimentation

HDRC

Health Determinants Research Collaboration
HIN
Health Innovation Network
HIT
Health Integration Team
HRC
HealthTech Research Centre
NIHR
National Institute for Health and Care Research
PPIE
Patient and public involvement and engagement
RDN
Research Delivery Network
RSS
Research Support Service
SWOT
Strengths, weaknesses, opportunities and threats

Declarations

Ethics approval and consent to participate

Not applicable. This study examined organisational design and early infrastructure development using programme documents and structured reflection by authors involved in the work. It did not involve the collection or analysis of research data from human participants, human tissue or animals, and no identifiable participant-level data are reported. Research ethics approval and consent to participate were therefore not required.

Consent for publication

Not applicable.

Competing interests

The authors include ARC Wessex Directors, theme and capability leads, operational staff, consultants and public contributors involved in developing the infrastructure described in this paper. KAJ and SW provided consultancy services to the University of Southampton and ARC Wessex during infrastructure development. The authors declare no other competing interests.

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Author Contribution

MB conceived the paper, led the infrastructure architecture, the documentary analysis and drafted the manuscript. CB co-led regional engagement and programme development, contributed to the infrastructure design and interpretation, especially the collaboration hub, and critically revised the manuscript. NAA, SMO, SC, SCo, VP, MCP, DK, LAF, SMc, JM and CDO contributed research-theme and Flagship perspectives, interpretation and manuscript review. MH, CT, AHan, CS, SF, CDr, NIIK, JR, KL, PD, LC and KI contributed expertise in research inclusion, community engagement, public involvement, methods, knowledge mobilisation, implementation and research capacity development and critically reviewed the manuscript. SD, ID, JH, HS and RM contributed public and lived-experience perspectives, particularly in relation to inclusion, participation and governance, and reviewed the manuscript. RTr, RH, RTo, CDa, KJ, AH, MW, KB, PM, KAJ and SW contributed operational, system, industry, knowledge-mobilisation and programme-development evidence and interpretation and critically reviewed the manuscript. All authors read and approved the submitted version. Each author agrees to be personally accountable for their own contributions and to ensure that questions concerning the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Availability of data and materials

The documentary sources supporting the analysis are described in the manuscript and its internal evidence register. Some source documents contain internal governance or operational information and

are not publicly available. Requests for access to non-confidential materials may be made to the corresponding author and will be considered subject to organisational approval and applicable confidentiality, contractual and data-protection requirements.

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Figures

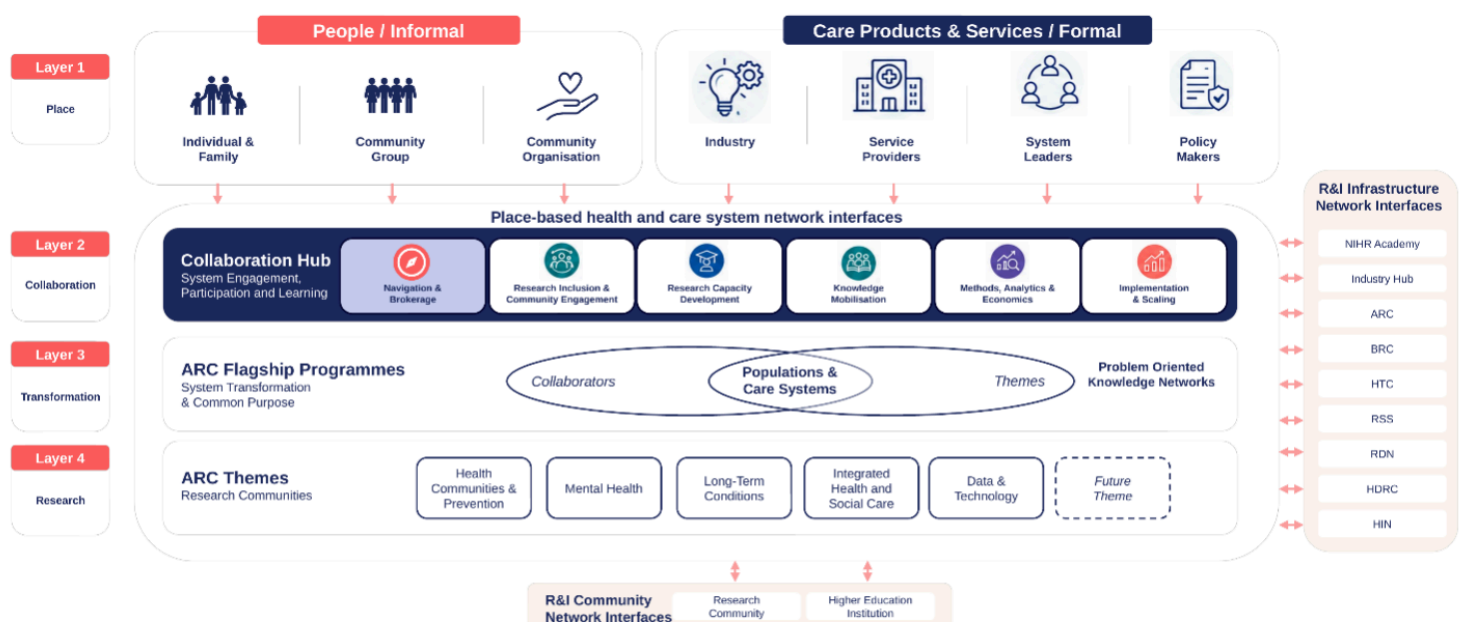


Figure 1

ARC Wessex infrastructure architecture and its four connected networks.

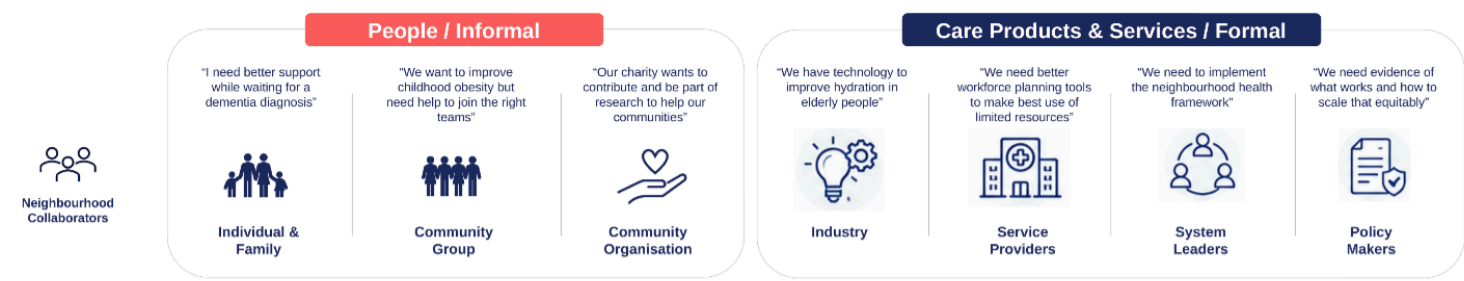


Figure 2

Place-based system collaborators, expressed priorities and institutional relationships.



Figure 3

ARC Wessex Participation Pathway linking collaborator discovery to research participation and learning.