UKPRP-FUNDED CONSORTIA'S SYSTEMS APPROACHES T0 PREVENTION RESEARCH

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SYSTEMS THINKING AND COMPLEX SYSTEMS INTEREST GROUP
Prevention Research Network

Contents

What is the UKPRP?

The UK Prevention Research Partnership (UKPRP) is a multi-funder initiative that supports novel research into the primary prevention of non-communicable disease (NCD) to improve population health and reduce health inequalities. The Prevention Research Network is currently managed by members from UKPRP funded Networks and Consortia, and its members are made up of researchers from across the prevention research community.

What is the Prevention Research Network? (Formerly Community of Practice)

The UKPRP Prevention Research Network (PRN) evolved from the Community of Practice, which was focused on the research practice solely of UKPRP funded groups. The PRN is an extension of this, providing a forum to share ideas, opportunities, and challenges across the whole prevention research community. By exploring experiences, the whole research community can learn from one another, to jointly improve ways of working to support NCD prevention in the UK. The PRN provides a place to share learning across key topics of mutual interest. Its approach is iterative, responding to the needs as they emerge, with new topics of interest being introduced, particularly following the inaugural Prevention Research Conference in 2023. Over time, the PRN will build a body of publicly available knowledge, methods, and tools to share learning with each other and the wider prevention research community. This can be found here.

The UKPRP Consortia

Each UKPRP Consortium is a novel combination of partners, representing a range of academic disciplines, and including, where appropriate, industry (such as commercial/business) partners. The consortia are undertaking transdisciplinary research addressing specific challenges in the primary prevention of NCDs. Research strategies are co-produced with stakeholders including policy makers, practitioners, civil society groups, health providers, and the public. These stakeholders may also be part of the consortium. By drawing together teams of experts from different disciplines and sectors, and including users, the consortia should enable researchers to capitalise on a range of expertise to develop innovative research into high-quality interventions that can deliver change at a population level.

The funded Consortia are listed on page 16 with a brief description of their key aims and objectives of using a systems perspective. In the main, the consortia are using a systems lens to understand their area of interest more comprehensively - whether it be the commercial determinants of health, child or young person health and mental health, or urban spaces - to identify interventions likely to improve population health. A second objective is to use systems approaches evaluatively to determine if and how these interventions have been successful. Goals of the work include sustainability and generalisability.

1. Background

'Systems approaches' is a term with different meanings for different groups. For instance, 'systems approaches' is commonly used in academic settings to refer to the set of principles, concepts, frameworks, methods and techniques, coming from multiple disciplines, that help us understand, interrogate and act upon systems. On the other hand, many of the consortia partners uses 'systems approaches' to refer to the set of actions planned and or implemented to address an issue, where each of these actions would target a different aspect or audience associated with the issue. For instance, a systems approach to healthy eating in a school would have actions tailored to children, parents and carers, the catering team, and the teaching team.

The root of systems thinking in public health can be traced to early 20th-century, with the development of systems-based frameworks for understanding disease transmission within populations, the recognition of the interplay between social conditions and health outcomes, and the advocacy for multi-sectoral approaches to address health inequities. However, only more recently systems approaches have been more widely used and recognised in public health research and practice. This shift gained momentum as other approaches conventionally used in public health became insufficient to, alone, investigate and tackle complex public health challenges, such as chronic diseases and health inequalities.

Acknowledging this shift, The UKPRP's remit is strongly influenced by findings of the 'Improving the Health of the Public by 2040' report, published in 2016 by the Academy of Medical Sciences. The report identified that to address the pressing and complex public health challenges of our time, interventions would need to be more adequate to the multiple (inter)actions within complex adaptive systems. This helped to create the conditions for systems approaches to gain space within the UKPRP initiative, with all consortia incorporating them in their programme of work. There is a wide range of systems approaches being incorporated by the consortia. However, barriers to a wider and more grounded adoption of these approaches still exist, in part because there is still a need to build research capability and capacity to use and further develop them. There is also a danger that should systems approaches not live up to the expectations of researchers and communities that use them, that they fall out of favour when they have a lot to offer. Based on that, a PRN on systems thinking and complex systems has been set up to be a space that facilitates the sharing of best practices, knowledge and resources on systems approaches, as well as the cross-fertilisation of ideas to maximize the outputs of UKPRP Networks and Consortia.

This report provides an overview of the systems approaches used by the different UKPRP consortia, including what aspects of systems approaches members thought were particularly useful, and the challenges to using systems methods. The results of our analysis are presented below.

2. Methods

This report utilised a mixed methods approach: Thematic analysis of recorded online webinars, document analysis of consortia decisions, challenges and successes of using types of methods for systems approaches, as well as follow-up correspondence with 1-2 members of each consortium to ensure fair and accurate representation.

As part of the PRN's Interest Group on Systems thinking and complex systems, all seven UKPRP-funded Consortia presented their plans and experiences of taking a systems approach to their respective topic. These webinars were recorded so that members of the Interest Group who were not able to attend at the time could later watch on the webinars. Six different webinars (one being jointly hosted by two Consortia) took place between March 2023 and May 2024 and were recorded

using Microsoft Team's record function. The webinars lasted 79 minutes on average (range 62 to 89 minutes). Each Consortium was free to present how they wanted, but with the remit of providing an overview of their Consortium's systems approach, what methods they are using, some examples of what they are doing or have done, and any issues and challenges they have encountered.

We sought to thematically analyse these webinars in which each of the seven UKPRP-funded Consortia presented in order to better understand views on taking a systems approach within prevention research, the practical and methodological challenges they faced, as well as examine how these Consortia overcame these issues.

The webinar recordings were professionally transcribed in full. Themes were identified inductively by LB reviewing the transcripts and developing an initial thematic coding framework, which was revised following discussion between LB & JGM. Coding of the transcripts was conducted by LB. Framework Analysis[1] was employed for all transcripts after the coding framework was finalised, as this method lends itself well to in-depth analysis of each transcript, summarising the data into a framework grid using NVivo 14. The wider context of each presentation is therefore retained across each transcript. Within the framework grid (row = participant, column = theme) summaries of each presentation was written in each relevant cell. Following this, high level themes were identified by LB and discussed with JGM.

Supplementary documentation was provided by each of the Consortia. This included additional information relating to why the Consortia used certain methods, as well as highlighting their challenges and successes of using these methods. These documents were also utilised in the formation of the findings in this report. This report was also informed by follow-up correspondence with the presenters to ensure fair and accurate representation of each Consortia.

The results focus on three broad areas:

- How are the different consortia undertaking systems approaches
- What are the challenges faced when undertaking systems approaches
- Outputs and evidence of impact

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[1] Srivastava, A. & Thomson, S. B. (2009). Framework Analysis: A Qualitative Methodology for Applied Policy Research. JOAAG, Vol. 4. No. 2

Why did Prevention Research Consortia take a systems approach?

Systems approaches are a way of uniting diverse voices and contexts, capturing evolving policies, and representing ideas in a comprehensive way that transcends traditional public health methods. They can facilitate decision making by enabling consortia to identify where to target interventions to maximise their potential for effectiveness or understand how an intervention may change the existing system. A systems approach enables the consortia to illustrate how areas not traditionally associated with health can influence and prioritise public health.

3. How are the different consortia undertaking systems approaches?

3.1 What are the objectives of a system focussed approach?

A primary objective of utilising systems approaches was the ability to map or model the system of interest, identifying levers which had the potential to influence outcomes if interventions were targeted there. These maps and models were described in different ways across the consortia, e.g., system map, organisational map, causal model, conceptual model, but they essentially served similar purposes.

> *we're working in these spaces and when we're trying to understand the end: think about the complexity of the local context, of the history of what some of these trends have looked like over time, the different areas for intervention, leverage points within the system.* (Systems Researcher, Kailo)

A second objective was to use a systems lens reflectively to evaluate work being undertaken by the consortia and understand whether or how it was changing the system.

> *using systems approaches to understand what the project is doing, rather than taking a systemic approach to making an intervention itself* (Systems Researcher, ActEarly)

Several consortia cited Foresight Obesities[2] as an example of being at the vanguard of using systems approaches in public health; however, they were all – in different ways – trying to go beyond systems mapping.

> *my view in Public Health is that systems thinking is probably predominantly group model building and notions of causal modelling, such as the obesities map, whereas we're bringing much more than that…* (Systems Researcher, GroundsWell)

Integrative and multi-pronged systems approaches were described which included qualitative, quantitative, and simulation methods; developing ways to integrate the outputs in a coherent, multi-facet or -layered synthesis model. Systems change was referred to, such approaches extending beyond the immediate project teams to include whole communities in thinking about and creating change. The work was to be generalisable to other geographical areas and localities, and also other policy areas, bringing systems thinking into the mainstream and increasing awareness of systems approaches amongst those who were not necessarily familiar with it.

3.2 Who or what had informed their work and process

The consortia used multiple sources to inform and build their system maps and models. The process was typically iterative, with consortia validating the existing scientific literature relevant to their

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[2] Vandenbroeck P, Goossens J, Clemens M. Foresight, tackling obesities: future choices building the obesity system map. London Gov Off Sci 2007.

context through knowledge exchange with policy partners, practitioners, and the public. Additional sources included policy documents, health promotion materials, social media, and emails.

> *So we knew that from the literature and from the review of urban development in the phase one interviews, we knew various different…we had various different understandings about what might be going on and what the priorities might be.* (Systems Researcher, TRUUD)

> *Maybe sometimes one's taking the lead and one's kind of on the side as kind of a framework of thinking, but they're always embedded together, and the evidence itself is thinking about how do we build upon knowledge that already exists about mental health, about the social determinants of mental health, about trends, and in terms of what has exits within those areas, and then also how do we build our own evidence at the same time? (*Systems Researcher, Kailo)

These different sources were not always fully concordant. Consortia had to consider how to best reconcile conflicting causal pathways, identifying what was most meaningful and relevant for their particular system.

Co-production was used throughout the process, including: informing models, model validation, identifying and deciding on interventions, developing tools, and visualisations. The consortia varied in who they involved in co-production work and the extent to which this drove the direction of the projects. Consortia working with particularly vulnerable populations, prioritised capturing the experience of those with lived experience to ensure outputs were meaningful for these groups. One of these consortia described local stakeholders as 'partners' in the work and significant resource was provided to support this work. Where more theoretical approaches were undertaken, co-production was used in a more tentative and exploratory way.

Other key voices came from practitioners and those working in policy. In addition to including these groups in focus groups and interviews, 'embedded researchers' or 'researchers in practice' were based in the sectors of interest to further aid understanding.

Existing evidence was synthesised and presented in numerous ways, including: systematic reviews[3], a metatheoretical review based on a selection of key papers[4,5,6], and more experimental approaches designed to capture the broad policy areas of interest. These methods included evidence gap maps[7], qualitative reviews synthesising community perspectives, narrative summaries (embedded within layered systems maps), and bibliometric citation analyses demonstrating how research is clustered.

3.3 Methods and sources of data used

Mixed methods approaches were reported. Qualitative work involved interviews and focus groups with stakeholders to assist group model building. Other forms of group work were used to generate consensus when developing models informed by large quantitative datasets (e.g., the census, Understanding Society, plus many others). These datasets informed microsimulation models, other

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[3] Petticrew, M., Glover, R. E., Volmink, J., Blanchard, L., Cott, E., Knai, C., Maani, N., Thomas, J., Tompson, A., Van Schalkwyk, M. C. I. & Welch, V. 2023. The Commercial Determinants of Health and Evidence Synthesis (CODES): methodological guidance for systematic reviews and other evidence syntheses. Syst Rev, 12, 165.

[4] Lewis MW, Grimes AJ. 1999. Metatriangulation: Building theory from multiple paradigms. The Academy of Management Review 24(4): 672-690.

[5] Ritzer, G. (2001). Explorations in social theory: From metatheorizing to rationalization. London: Sage.

[6] Paterson, B. L., Thorne, S. E., Canam, C., & Jillings, C. (2001). Meta-theory. SAGE Publications, Inc., https://doi.org/10.4135/9781412985017

[7] Campbell, Fiona; Llewellyn, Jennifer; Chambers, Duncan; Wong, Ruth; Meier, Petra (2025). Employment and Health Evidence & Gap Map. The University of Sheffield. DataSet. https://doi.org/10.15131/shef.data.27619617.v1

systems models and causal models, and decision tools. Models were predominantly driven by the outputs of co-production, apart from one consortium which was taking a more theoretical approach, using meta-triangulation and metatheory. The type of models produced partly depended on the resources available and the expertise of the team.

3.4 How the systems work linked with other aspects of the work being undertaken

The extent to which each of the consortia reported using systems approaches throughout their projects varied. When commented on, consortia typically reported that whilst they had a particular work-package focussing on systems work, systems thinking was underpinning all the work they were doing, sometimes with a distinction between systems informed and systems led.

> *That is not just about doing that from a systems perspective, there is a qualitative valuation and there are other kinds [of] evaluations as well.* (Systems Researcher, ActEarly)

> *We have systems thinking as something that is really underpinning a lot our approaches to that, and we've... and we've done that in various different ways across a project and are continuing to embed that* (Systems Researcher, Kailo)

> *everything is Systems Informed but it isn't necessarily always going to be led by a Systems [approach]...* (Systems Researcher, TRUUD)

4. What are the challenges faced when undertaking systems approaches?

The analysis suggested 6 key challenges. These ae reported below, with strategies the consortia used to address and overcome them. The final section offers general strategies for overcoming challenges when using a systems approach.

4.1 How do you define the target system of interest?

A challenge reported by all the consortia was defining the boundaries of their system. Systems do not have a set boundary, nor are they temporally static. Trade-offs were required between time, financial resource, influence, and data availability. Irrespective of the resources available however, the goal was not to expand the map until resource, or data were exhausted. Rather, maps needed to be fit for purpose and able to answer the questions pertinent to policy makers, whilst also capturing, or at least being mindful of, systems evolving over time and shifting in response to external events.

> *What is the boundary of the children's health system? What does it mean to map that? What would that map look like and then how do you kind of overlay the activities of a project on that system in a way that gives you sense of things like leverage points or positions of influence and that kind of thing? Then finally, if you can do that, how do you actually attribute change to what you're doing in a way that isn't just completely subjective?* (Systems Researcher, ActEarly)

Consortia were keen to ensure their maps were meaningful and not excessively complex to the point that it impeded interpretability, nor overly simplified to the extent that they risked misrepresenting the real world. For some consortia it was important that at least some of their maps captured the narratives of those with lived experience. Some consortia reported concerns regarding subjectivity, which could lead to ineffective interventions being designed.

- When working with large amounts of data, AI or other mechanisms may be useful during the data reduction phase, making the process manageable, and reducing the risk of subjective bias.

- Work with relevant partners to ensure outputs are meaningful and interpretable for those involved.

- Target interventions do not need to be overly complex.

  although systems are incredibly complex, you don't have to have very complex interventions to prevent a system operating. You can sometimes pull one lever in a system and completely alter things and I think that example of getting [alcohol industry educational materials removed from] schools [in] Ireland is one example. (Systems Researcher, SPECTRUM)

4.2 Working with different groups and accommodating their priorities and timelines

Adopting a systems perspective involves uniting diverse stakeholder groups, typically: academics, policy makers, practitioners, and community stakeholders. Involvement with industry could be fraught with difficulty, due to inherent conflicts of interest and the selective sharing of information. In the case of research on the commercial determinants of health, commercial actors are not directly involved, rather their activities and framings can be understood and analysed in other ways, for example via Freedom of Information requests.

Whilst co-production was essential to the success of the projects, getting people to move beyond their disciplinary silos and work together could be challenging. This required an alignment of divergent academic and policy maker timescales and priorities. Academics were typically described as having a considered, systematic approach to their work, identifying potential problems and pitfalls *a priori,* with a practice of protocol writing. Conversely, policy partners were more familiar with responding and reacting to rapidly shifting priorities. Where not managed effectively, this could lead to disengagement from policy stakeholders.

  Academic and policy partners operate on completely different timescales, policy partners are obviously expected to deliver policies relatively quickly and the academics take a while to come up with the quality of output that they want to produce. That there are often conflicting expectations (Systems Researcher, TRUUD)

Some admitted avoiding including a political perspective to their work, but acknowledged this was necessary to facilitate model development. When working with large policy organisations, it could be difficult to identify who was responsible for a particular element of policy. The process was reliant on honest conversations between stakeholders. Civil servants could be reticent when voicing their opinions, impeding their capacity to engage. Maintaining engagement with community stakeholders for the duration of the project was also acknowledged as an area that could be challenging.

Despite the challenges observed, the combining of different voices in the process was seen as an essential component of the work:

  It definitely seems increasingly important, and I'm glad about this, but I was also surprised about this, to think about how you integrate public views and lived experience and that qualitative understanding in evidence when you're bringing it into policy spaces. (Systems Researcher, SIPHER)

- Properly resource co-production so that it doesn't appear tokenistic.

From the beginning we already wanted to include young people in the programme like being... working with us, but for many reasons around administration and bureaucracy and different things that I'm not gonna go too much into it: we couldn't do it when we wanted to, well we couldn't do it... like we could do it here. But then what we realised and is that we also had to allocate money to community organisations, and quite a bit of money from the process in order for them to participate more meaningful... more meaningfully in this project, and also influence decision making in those spaces. (Systems Researcher, Kailo)

- Manage expectations between policy and academic stakeholders by using embedded researchers who are based within local policy and practitioner teams and can gain tacit knowledge. For this to be successful, those appointed need to be confident and engaged in their role.

  it's good to be able to be on the ground as a Researcher in Residence to try and manage some of those expectations. (Systems Researcher, TRUUD)

- Researchers require grit and tenacity, so they are not dissuaded when faced with opposition. This resilience could also apply when trying to identify which methods and approaches would be successful and/or efficient. It may be necessary to try different strategies and be pragmatic based on your resources on what can be achieved.

- Encourage people out of their silos to accumulate critical mass.

- When researching industry or areas that may be difficult or unethical to work with directly, indirect methods can be more appropriate.

4.3 Producing a shared and meaningful understanding of what a systems approach is

One goal of using a systems approach is building a shared understanding of the health system in question. It could be challenging achieving that shared understanding when different stakeholder groups had differing levels of understanding of how systems work: some had none, some were experts, and some perhaps understood systems terminology to mean different things than others. For those not coming from a systems background, the approach could be overwhelming. It was therefore essential that systems terminology was introduced early, and used consistently, to avoid confusion down the line.

  …really fine balance to get between like exactly what people mean. (Systems Researcher, Kailo)

Inconsistencies in the meaning of systems terminology was not just an issue amongst different groups, but was also a challenge when interpreting the academic literature, or adapting academic language so that it translated to the realities of local people's lives.

Strategies for success

- Clarify with teams, partners and stakeholders what their understanding of systems and other key concepts are and align it with the perspective of the consortia. It can be helpful to give everyone the opportunity to work on the systems map.

  In the process of creating them and particularly the team maps working with the teams across the different universities and the consortium, I think it's really helped to facilitate a degree of systems thinking within those teams. People started from very different positions across, from knowing about Systems thinking and thinking it's a good idea, not knowing anything about it, knowing about it but thinking it's a bad idea. So, to give them that experience of working on those maps, I think it's definitely helped in their mindset to be thinking about the relationships between the kinds of things they're thinking about… (Systems Researcher, TRUUD)

- Introduce an agreed terminology and system definition early, repeating this process throughout to accommodate staff turnover.

  One of our experiences is generally finding that we don't spend enough time at the beginning, to actually say what do we all think? Where are we coming from? Think of the icebergs. What are beliefs and attitudes which is informing our thinking and not so much the structures? (Systems Researcher, GroundsWell)

- Co-production enables you to identify which questions your work can answer that are also of interest to policy partners.

- When working with different levels of organisations, e.g., local, regional, national, it may be easier at the outset to work with those that are nested within one another.

- A flexible, inclusive, and adaptable approach is fundamental to successfully getting policy makers and partners on board with a whole systems approach.

4.4 How do you capture impact in a system whilst being cautious about attributing causality?

Several consortia acknowledged the need to be cautious when attributing causality, but without doing so limited the potential impact of their work. In addition to identifying linear pathways of causality with caution, consortia reported it was important to understand the 'hierarchy of purpose' when identifying potential levers in a system to identify whether these levers were at the local, regional or national level.

Strategies for success

- Identify other measures of impact in addition to/instead of causality.

  So our starting point often being, what would we expect to see the outcome of the intervention, what are the indicators of that and state how we measure success and then evidence against it, to actually face up and have that conversation and what do we take success to be and this is how we're measuring it. (Systems Researcher, Groundswell)

- Identify tangible outputs for partners and stakeholders. Examples include producing collaborative glossaries, documents reporting systems approaches available for a policy area, real life applications on improving systems co-ordination, and including lived experience peer research.

- Present causal pathways informed by stakeholder views with caveats whilst acknowledging they can be helpful in structuring thinking. These relationships can then be tested using data if/when it becomes available.

  [We] understand all the problems about casual inference but […], we've been very clear what assumptions we're making, [and] have a go at doing that in order to influence policy and practice. Because otherwise what are we doing? I mean there's nothing wrong with pure theory, I think, you know, lovely, in another lifetime that's what I would have loved to do. But in this lifetime what [we are] really interested in is making a difference around violence prevalence and impact [by encouraging systems thinking], and therefore somehow we've got to move back into at some point saying okay we have enough confidence that there's some causality here. (Systems Researcher, VISION)

4.5 Sustaining a systems approach beyond the life of the project

Ensuring sustainability of the systems approach was a challenge particularly cited by those who were working with local communities. Being time and resource limited, the consortia had to win hearts and minds in the localities they were working in to have a lasting impact.

How can it sustain, spread and encourage the uptake of systems thinking, when programmes are also starting and ending? So what impact does this have on momentum after these projects end? Probably something that we all consortia are considering, how we keep that momentum going, after the project ends. (Systems Researcher, GroundsWell)

One consortia has produced a framework which focusses on sustaining their approach in their existing project sites and will be used to support new sites adopting their systems approach.

Strategies for success

The consortia identified specific strategies and tools to encourage sustainability following the end of the project. These included:

- Getting buy in from key individuals who were working in the area of interest and were likely to be there beyond the life of the project.

   Creating buy in, even if it is just with one or two key individuals who can win hearts and minds about systems thinking. (Systems Researcher, ActEarly)

   Ongoing development is very much coming from the East Side Partnership and it seems to be the energy of one or two people. It leads me to the question, is this an indicator of success in that you need to have one or two key people with energy, to keep chipping away and making it happen and if that is not present is that going to have an impact? Otherwise, what is the motivation that brings people together coherently, with a common purpose, despite the conflicting priorities to try and achieve the outcome? (Systems Researcher, GroundsWell)

- Engaging in meaningful co-production with relevant stakeholders and strategies within the community, that will be sustained by the community.

   to increase the probability of sustainability after the project finishes is to have co-production of the understanding of the system, but also the possible solutions, as a very fundamental pillar during the project. (Systems Researcher, GroundsWell)

- Create tools and visualisations of health impacts that are accessible to the public and those responsible for decision making.

- Using the system map to identify areas which are having a positive impact so that direct resource to these areas is maintained.

   we've got a project log of ActEarly and how its various tentacles reach out into the community, so to overlay that on top of those more conceptual or influence models with the intention of saying well ok, this is where ActEarly is in this children's health system and we can try and then draw some conclusions about what ActEarly might be doing. Then it may also then be possible to say, well there are some structures in this network that might not have existed had ActEarly not come along and put effort and resource into those areas and maybe they will persist beyond the life of the project and have some real influence on children's health in these places. (Systems Researcher, ActEarly)

- Provide access to practical tools to support work which is focusing on systems, the social determinants, and prevention.

4.6 External events that influence the system or the work undertaken

Some consortia acknowledged the challenges of responding to unexpected external events. These challenges included the Covid-19 pandemic, the cost-of-living crisis, and new policies being introduced. These events made it harder to engage with stakeholders, either due restrictions to working practices (e.g., moving online during the pandemic), or partners not having capacity to contribute as planned due to competing priorities.

It was not ideal, it was really difficult mentally and getting people for long enough. You know, if you... if you have them in a room and you can feed them in between and you can structure it a bit more easily and don't have to worry about them running off, that's a different situation and works much better. But anyway, we did it online, it worked to a degree; we had relevant partners. (Systems Researcher, SIPHER)

Strategies for success

The consortia responded to these challenges through flexibility and adapting their processes. During the Covid-19 pandemic, consortia reported moving face to face events online, which worked with varying degrees of success as this adaptation led to a lack of continuity with stakeholders. One researcher reflected how viewing such events through a complex systems lens was a useful way to respond to and learn from these unplanned events.

I think the crisis of the pandemic in particular and the cost-of-living crisis as a practical example has thrown up a lot of things that is really shaken the foundations of the dominant way of saying we understand this problem and we're going to approach this problem. So I think there is something even there around when you're in a space of multiplied crisis and complexity, you know, complex science principles might help us to learn more about how we might adapt and be adaptive and the systems could adapt and be more resilient. (Systems Researcher, VISION)

4.7 General strategies for success and critical reflection

- One key recommendation was that of being transparent in the work that was being undertaken. This could be in terms of documenting what has been done and why, but also in terms of describing the current policy system and whether it is stable or evolving. Transparency allows for replicability and enables others to understand your process even if they may not necessarily agree with it. Documentation may take the form of a published protocol, or even a set of principles that will guide decisions/ trigger certain actions.

  So when it comes to the process that we're going to through to develop this understanding of children's health system and also Act Early, we are trying to, at least and that is when it comes back to the notion of the protocol as well, is at least document how we went about it, so people can say, well ok, I understand how you got there, I don't necessarily agree with what you ended up with, but that doesn't necessarily matter. (Systems Researcher, ActEarly)

- Allowing models to feed into one another allows for extra functionality.

  it's quite exciting now that everything is joined up that, you know, the synthetic population feeds into the systems dynamics model, and the systems dynamics more into the decision tool, and the decision tool can search space, identify new interventions which can then send through the whole thing again, so that makes for quite a lot of extra functionality. (Systems Researcher, SIPHER)

- Be appreciative of small wins.

  a systems perspective actually lends a little bit of hope thinking about non communicable diseases and thinking about a different sort of nodes for intervention. I mean I think realistically the history of action on these kinds of issues, it has been fragmented, it has been incremental but in some ways it's been quite radically incremental and I think there's value in sort of taking heart from the small wins. (Systems Researcher, SPECTRUM)

- Acknowledge that models aren't perfect, and it will sometimes be more appropriate to use other methods.

So its aligned with George Box's idea that all models are wrong but some are useful or Korzybski's – the map is not the actual territory – and that's part of I think the fundamental underpinnings of Systems Foundation, the maps that we're building are epistemological devices as one of my former colleagues used to say, it's a way to help the project, the people we're working with articulate, explore, think about a complex system, it's going to have limitations. It's not necessarily 100% representative, it's a simplification in lots of ways. But it is there to facilitate our kind of Systems Thinking, our understanding, work out where our gaps are, where leverage points maybe, where we need to direct more resource or study more. (Systems Researcher, TRUUD)

- Prioritise looking for measures that capture agency and influence from organisations.

    we probably do need to spend a bit of time as a field, if there is such a thing, if systems thinking is a field, but looking for alternative measures. The things that came to mind is that a lot of when I do systems work with organisations, they get very worried about agency. It's like, oh are you telling us that we have no control over our organisation. That is obviously not true. We've all experienced the differences in managers and their influence on organisations and as management changes the culture, the feeling, how an organisation behaves, how effective it is changes as that management changes, so there is some agency there, but I think the way we perhaps measure that influence and that change is perhaps very narrow, like you say. It's based on some fairly kind of – perhaps to use the, or a word of the day – it's a bit neo-liberal. It comes down to perhaps, have we increased people's money or decreased the amount of money we are spending and improve people's lives. (Systems Researcher, ActEarly)

5. Outputs and evidence of impact

Dissemination has occurred via both academic (for example: peer reviewed articles, conference presentations, and/or lectures) and policy facing channels (for example: webinars, workshops and meetings with policy partners). Some had working models, decision tools, or system maps, but fewer had specific evidence of impact. In one instance where this was available, the consortium described how their work had led to acknowledgement from government that regulation was required (although this regulation was yet to be implemented) and the removal of industry stakeholders from schools in Ireland. That this was a long process was emphasised.

    'cog in the wheel', 'I sort of see it as playing a long game' that doing the research and defending the research and putting doubt that sometimes actually it has quite a big impact, even quite small studies that we've done, because the process of de-normalising the harmful activities of some of these big actors, it can sometimes have a big impact even, you know, in quite a small way. (Systems Researcher, SPECTRUM)

6. Closing remarks

The reflections of the different consortia on their use of systems approaches highlight some common areas of value. For example, a number of consortia discuss how systems approaches have helped them develop their own understanding of the target system of interest, both internally among the consortium members and externally with partners. A number of consortia mentioned systems approaches, such as group model building or participatory systems mapping, being used to develop what could broadly be characterised as a shared understanding of the system of interest, used as a way of surfacing and then comparing different understandings and perspectives on a given system. Another area where systems approaches were highlighted was in discussions of how consortia decided both where and how to make interventions in the target system, and also in the evaluation of those interventions. Systems mapping, conceptual models of theories of change, development of interventions, and then evaluation of the interventions, are all key aspects of systems approaches. It is therefore reassuring but not surprising that this came through in discussions.

It is also worth highlighting, however, that systems approaches are frequently used alongside other approaches, and there were differences between consortia as to whether systems approaches were used to inform particular aspects of the research or instead to frame all of the research programme. It is tempting to consider if it would be possible to do a meta-evaluation on the consortia to perhaps determine whether the degree to which systems approaches were embedded in their approaches had an impact on how well the researchers felt the project as a whole had gone. However, this would not be a straightforward piece of research to undertake. Nonetheless, this high-level synthesis document has revealed that there are potential opportunities for further developing an overarching theory of change on use/utilisation, based on the aims and reflections of the different consortia.

Few of the consortia noted that systems approaches can require significant resources. For example, systems mapping exercises can consume significant amounts of researcher and partner time, as can things like group model building. The digitisation and analysis of the output of such exercises can also be time consuming. It is therefore important that the reasoning for deploying some systems approaches is clear, reflexive, and iterative; as does what the researchers and partners hope to achieve from the exercise, and that those expectations are realistic. This is important for the future of systems approaches in prevention research. If there is a sense that the approaches are not delivering the expected results, and engaging with complex emergent problems of our time, they might once again go out of favour.

The funders

No single research funder has the resources or expertise to address the complex factors and systems influencing health on their own. Therefore, a partnership of twelve funders including charities, UK Research and Innovation (UKRI) councils and the UK health and social care departments established the multimillion-pound UKPRP. For further details of the remit of each partner, please refer to the links below.

- British Heart Foundation
- Cancer Research UK
- Chief Scientist Office (Scottish Government Health and Social Care Directorates)
- Health and Social Care Research and Development (Welsh Government)
- Economic and Social Research Council
- Engineering and Physical Sciences Research Council
- Medical Research Council (MRC)
- Natural Environment Research Council
- National Institute for Health Research
- Public Health Agency (Northern Ireland)
- The Health Foundation
- Wellcome Trust

The MRC administers the initiative on behalf of the UKPRP funding partners.

The funded Consortia

ActEarly's aim was to improve **child health** in Bradford, West Yorkshire and Tower Hamlets, London, by focussing on upstream early life interventions. These areas both have high levels of child poverty. Whilst the systems work was predominantly undertaken within the evaluation theme, which is one of 4-5 core themes in the project, a systems perspective was taken throughout the consortia. An objective of the systems work was to produce local children's health system maps for Bradford and Tower Hamlets which informed a meta model of children's health that can be applicable more generically. Taking a systems approach was one of several ways the consortia evaluated the interventions they have developed. Once their children's health system had been produced, they worked to identify positive elements (interventions) within the children's health system which may not have existed without ActEarly, directing resource to these interventions to ensure they are sustained beyond ActEarly and can influence and improve children's health in these areas over the longer term. The systems map was also used to contribute to the project's understanding of which parts of the system it intervened in.

GroundsWell's aim is to improve understanding of the role of **urban green and blue spaces** within wider social, economic, environmental, cultural and health systems through creating a virtuous cycle of research, data, policy, implementation, and active citizenship. Through collaborative working they will identify and implement actions to maximise health benefits from urban green and blue spaces. Democratisation of the research and decision-making process will be based on principles of co-design, co-implementation, co-evaluation, and co-translation. As an example of the consortium's multi-pronged systems approach, causal modelling and organisational mapping are being used to develop a viable systems model of urban green and blue spaces, using Belfast as a reference case. The aim is to identify potential successful interventions which will be further tested in Edinburgh and Liverpool.

Kailo's aim is to improve the **mental health** of **young people** in North Devon and Newham, London. They hope to achieve this by working closely with local partners to build a shared and systemic view of the wider determinants of young people's mental health. Young people are at the centre of this process, and they will be involved in developing new strategies, allocating resources, and informing decisions that affect them. The work will focus on sustainability, making use of existing assets within the community as further funds are unlikely to be available.

SIPHER's aim was to **tackle health inequalities** and improve public health by focussing on the **social determinants of health.** These are the conditions in which we are born, grow, live, work and age. SIPHER believes all policy areas within government can ultimately affect health and health inequalities therefore there is a need to integrate health within all policies. SIPHER delivered evidence of the costs and benefits of the complex, interlinked and long-term consequences of policy decisions. This will help our policy partner organisations identify opportunities for the strategic alignment of policies across relevant sectors and give the confidence to change the way major investment decisions are made. Their goal was to be able to determine the impact interventions have on a system and knit evidence into a decision-making tool that can help with navigating synergies and trade-offs between outcomes.

SPECTRUM's aim was to focus on the **commercial determinants of health** and **health inequalities.** SPECTRUM used a system lens to generate new evidence to inform the prevention of NCDs caused by unhealthy commodities, including tobacco, alcohol and unhealthy food and drink. This approach showed how commercial determinants are legitimate public health actors that are influencing health systems. Their research aimed to transform policy and practice to encourage and enable healthy environments and behaviours.

TRUUD's aim was to prevent NCDs through changing the way **urban development** decisions are made. The consortium worked with key decision makers, local communities, and advisors at a national, regional and city level to embed health in the system of urban decision making. Through this work the consortium identified where most influence on decision-makers lies, then developed and tested ways to prioritise health. Their holistic upstream approach considered the commercial determinants of health, the role of the private sector, and systems of governance, rather than mid or downstream influences that are specific to the design of the urban environment and health outcomes. Work undertaken includes the integration of health in local spatial planning and policymaking and a city-region transport strategy in case study areas of Bristol and Greater Manchester. These frameworks were developed in such a way that they are generalisable to different localities.

VISION's aim is to **reduce violence** and the health inequalities that result, by informing policy and practice. Their complex systems approach will articulate causal pathways, developing a complexity-aware theory of change to inform violence prevention and mitigation pathways, and identify opportunities for developing and evaluating interventions. Gender and other inequalities are mainstreamed throughout the analysis. This consortium draws on multiple disciplines across the social and health sciences, including sociology, criminology, health, and economics. They are using data from the Crime Survey for England and Wales, third sector specialist services, police, health services and others.