



# A successful use of systems approaches in cross-disciplinary healthcare improvement

Julian Johnson  
Holistem Ltd  
81 Bluebell Way, Bamber Bridge Preston  
PR5 6XQ  
+44 1772 626923  
[julian.johnson@holistem.co.uk](mailto:julian.johnson@holistem.co.uk)

Fran Beck  
NHS Telford and Wrekin CCG  
Halesfield 6, Halesfield  
Telford. TF7 4BF  
+44 1952 580300  
[fran.beck1@nhs.net](mailto:fran.beck1@nhs.net)

Gary Smith  
Airbus Group  
Inglenook, Park View, Pontypool.  
NP4 5JT UK  
+44 7785 322778  
[gary.r.smith@airbus.com](mailto:gary.r.smith@airbus.com)

Alan Harding  
BAE Systems Air  
Victory Point, Frimley, Surrey GU16 7EX  
+44 3300 467305  
[alan.d.harding@baesystems.com](mailto:alan.d.harding@baesystems.com)

Copyright © 2018 by Johnson, Smith, Harding & Beck. Published and used by INCOSE with permission.

**Abstract.** UK Healthcare is facing many different trends: a changing demographic of an ageing and ‘frail’ population; increasing numbers of the population living with at least two long term conditions; improvements in medical care and interventions which can treat a larger number of conditions; continued budget pressures and raising expectations. Healthcare is a complex socio-technical system, and to identify and devise interventions with clear net benefits is a challenge: we see a classic ‘wicked problem’. The outcome from three INCOSE-facilitated multi-disciplinary workshops was a coherent prioritised work programme, with buy-in from all stakeholders, and traceable back to original issues and opportunities. This presentation will explain the context, the engagement from INCOSE, the nature of the workshops and techniques applied, and the outcomes. The developed programme supports the Shropshire and Telford NHS Sustainability and Transformation Plan (STP). Arguably the biggest ongoing challenge remains handling complexity and coherence across multiple stakeholder perspectives.

## Introduction

The UK National Health Service (NHS) Shropshire Clinical Commissioning Group (CCG) covers a large geography with issues of physical isolation and low population density within a mix of rural and urban aging populations. Shropshire is a large rural county with a population of approximately 308,000 which is set to rise to 320,600 by 2020.

Telford & Wrekin CCG has a large, younger urban population within areas of rurality. Telford is ranked amongst the 30% of most deprived populations in England. The population is approximately 170,000 and due to grow to 198,000 by 2031; the percentage of people who are aged over 85 is set to increase by 130%. Telford and Wrekin has a higher proportion of households with dependent children than the national average and a lower proportion of households where all residents are aged over 65.

People aged over 85 are nearly 10 times more likely to have an emergency admission than those aged 20-40. There is evidence that some patients who are admitted could have been treated in alternative

settings. Up to 40% of patients who are admitted to hospital remain longer than clinically necessary. With frail patients, if admitted, their re-admission rate is high and admission is often associated with physical deterioration.

Community interventions can have a significant impact on preventing admissions. However, the acute care interface remains a key point where older people with crises are assessed. The clinical assessment of frail older people is challenging due to non-specific presentation with frailty syndromes, which can obscure immediate diagnosis. Compounding this is the Accident and Emergency (A&E) 4-hour target, which tends to drive behaviour contrary to what may be in the best interests of the patient as the 4-hour point approaches.

In November 2013 the healthcare system undertook a major consultation exercise with public and clinicians under the national Call to Action for the NHS ((NHS 2013)). The response was very clear in saying that the public wanted full engagement in thinking through options for the future and that nothing should be predetermined. Nevertheless, in the light of the factors described above, there was real consensus between public and clinicians about the following:

- An acceptance of there being a case for making significant change
- A belief that this should be clinically-led and with extensive public involvement
- A belief that there were real opportunities to better support people in managing their own health and to provide more excellent care in the community and at home
- An agreement that hospitals are currently misused, not deliberately but as a result of poor overall system design and the lack of well understood and properly resourced alternatives
- A belief that it is possible to design a new pattern of services that can offer excellence in meeting the distinctive and particular needs of the rural and urban populations of this geography - but to succeed we must avoid being constrained by history, habit and politics.

Local clinicians and respondents to the Call to Action also saw this opportunity to systematically improve care as being a necessary response to address the many challenges faced by the service as it moves forward into the second and third decades of the 21st century.

A second body of material that provided context to these workshops, was the Five Year Forward View document (NHS 2014). This document explains why the NHS (note not healthcare in the large) needs to change (demographic changes etc.), what the future will look like, new models for change, and a high-level view of actions to move to the 'new NHS'. The Five Year Forward View document is significant in driving forward the development of Sustainability and Transformation Plans (or STPs), developed by all NHS health authority regions during 2015-2016.

## **Initiation of engagement with INCOSE**

Systems engineering (SE) can be applied in healthcare for many reasons including: it provides systems thinking (ST) techniques, tools and training that can synergise with existing quality improvement approaches; it can provide exploration and useful conceptualisation of current, and future, systems; it can blend agility (agile and bottom up methods) with structured top down approaches; it fosters integration across organisations, processes / stakeholders; it can support cultural and transformational change; when supplemented with an appropriate range of ST techniques it can help understand and potentially unravel wickedly complex system design problems.

Aware of the significance of the transformation challenge, in May and August 2016, members of the INCOSE Healthcare Working Group met with the Shrewsbury and Telford Hospital NHS Trust (SATH) to discuss the potential for INCOSE volunteers to work with the Shropshire and Telford & Wrekin health economy to (a) advance the delivery of health outcomes, and (b) advance the practice of SE and ST in healthcare, and subsequently to identify a meaningful workshop focus. The healthcare

sector representatives included the Chief Executive, SATH, the Director of Transformation, Shropshire Doctors Co-Operative Ltd, the Executive Lead for Commissioning Telford & Wrekin CCG, and the area STP Programme Director.

The INCOSE representatives (Harding, Johnson, Smith, an INCOSE Healthcare Ambassador) provided a short introduction to INCOSE and its potential offering to SATH, and explored the area's priorities to see if the groups could work together to mutual benefit. Two value adding activities were identified at the first meeting (elaborated further but just listed here due to lack of space):

1. Review the Shropshire and Telford & Wrekin Sustainability and Transformation Plan (STP) from a SE perspective
2. Bring a fresh systems perspective to the challenge of Frailty.

The INCOSE intent was, wherever appropriate, to share insights from this work with members of the Healthcare Working Group, and with the wider NHS community.

At the second meeting, the NHS agreed to support a workshop in September 2016 that would focus on the topic of Frailty, item 2 above. It was felt that focusing on a cross-cutting topic would help to build an overall understanding for the need and challenges of transformation. This understanding would be necessary to contribute to strategic planning in the STP whilst also exploring and conceptualising specific proposals to address the Frailty topic.

From September 2016, several members of INCOSE (linked to its Healthcare Working Group) have worked with a multidisciplinary group of healthcare stakeholders, led by NHS Telford and Wrekin Clinical Commissioning Group, to facilitate cross-disciplinary meetings. The engagement has brought additional experience in systems thinking and approaches, and provided facilitation focussed on the 'frailty' situation via three workshops involving up to 30 attendees representing over 20 healthcare organisations.

Through INCOSE facilitation, three economy-wide workshops held between November 2016 and January 2017 (illustrated in Figure 1):

- Mapped the care pathway from home; through the Emergency Department and the hospital; community care; long term and end of life care
- Mapped decision-making through the process to highlight 'issues' (areas for improvement) and 'opportunities' (improvement actions/ interventions/ approaches)
- Identified 'medium term issues' that need to be addressed including organisational structures; shared information; access to records; capacity and workforce issues
- Identified and prioritised actions to the frailty pathway and experience.

Topics tackled included: issues, opportunities, inter-agency communications, recommendations, and prioritisations. Techniques applied successfully included: structured "round tables", Systemigram visualizations, concept mapping, N-squared charts and causal loop modelling.

The following sections explain approaches adopted, techniques applied, and selected outcomes.

## Approach

**Preparation for Workshop 1 (WS1):** The introductory presentation by the NHS systems advocate needed to go beyond 'what is INCOSE and SE', to also show visualisations of what SE could contribute, in a form understandable to the healthcare participants at WS1. Several example 'conceptualisations' were included in the introductory presentation, and off-line analysis of the Frailty context was also performed. Two conceptualisations available for WS1 were a Systemigram of the healthcare domain, and a causal loop diagram from the Frailty context.

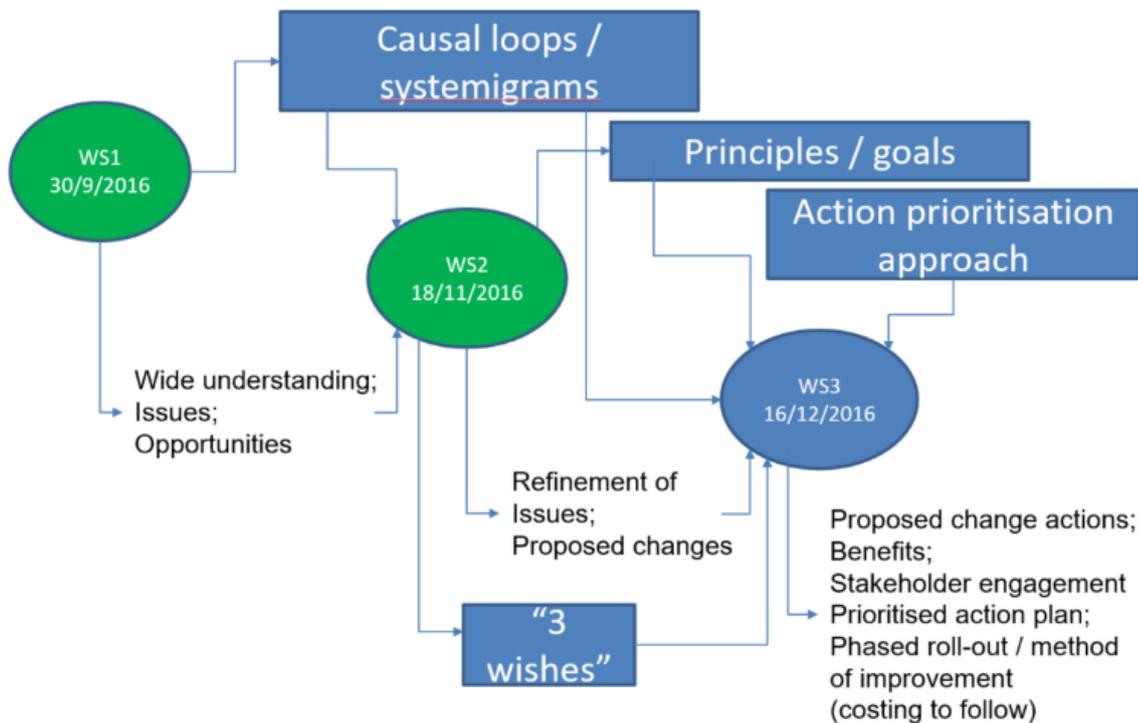


Figure 1. Sequence of workshops and outcomes

One illustrative Systemigram used is shown in Figure 2. This is conventionally organised starting from the top left, ‘tells a story’, and helps the varied stakeholders to understand the wider perspective and linked issues that characterise a domain.

The early dialogue with the NHS systems advocate provided information about the frailty domain chosen as focus, and introduced the systems engineers to the ‘Frailty Fulcrum’ from the work of Dawn Moody (Moody 2016). An illustration of the interdependencies underlying the Frailty Fulcrum, is provided as a simple Causal Loop Diagram, in Figure 3. This can be read (in part) as:

- Increase in **long term health issues** likely to increase **frailty**;
- Decrease in (standard of) **home environment** likely to increase **frailty**;
- Decrease in **mental health** is likely to increase **frailty**;
- Decrease in **social context** is likely to increase **frailty**;

...and so on.

Illustrations such as Figure 2 were included in the initial presentation at WS1 to successfully orient the healthcare attendees to visualisations that the SE community could bring to bear to facilitate the cross-disciplinary dialogue.

**Workshop 1:** This workshop was held in September 2016, with Harding, Johnson and Smith facilitating. We had been advised before the event of around 30 expert practitioners attending who would be representing a diverse set of departments, roles and 20+ distinct organisations. As such this presented a remarkable opportunity for systemic thinking and acting if we could provide the right framework for engagement. We structured the event into three streams following an overall presentation and scene setting. The theme for the three streams was loosely conceived as ‘the good, the bad and the ugly’ and thus to focus one stream on positives/opportunities, another on the challenges of organisational interactions and the final stream on organisational complexity.

Healthcare paradigm \_V5\_2016.02.15

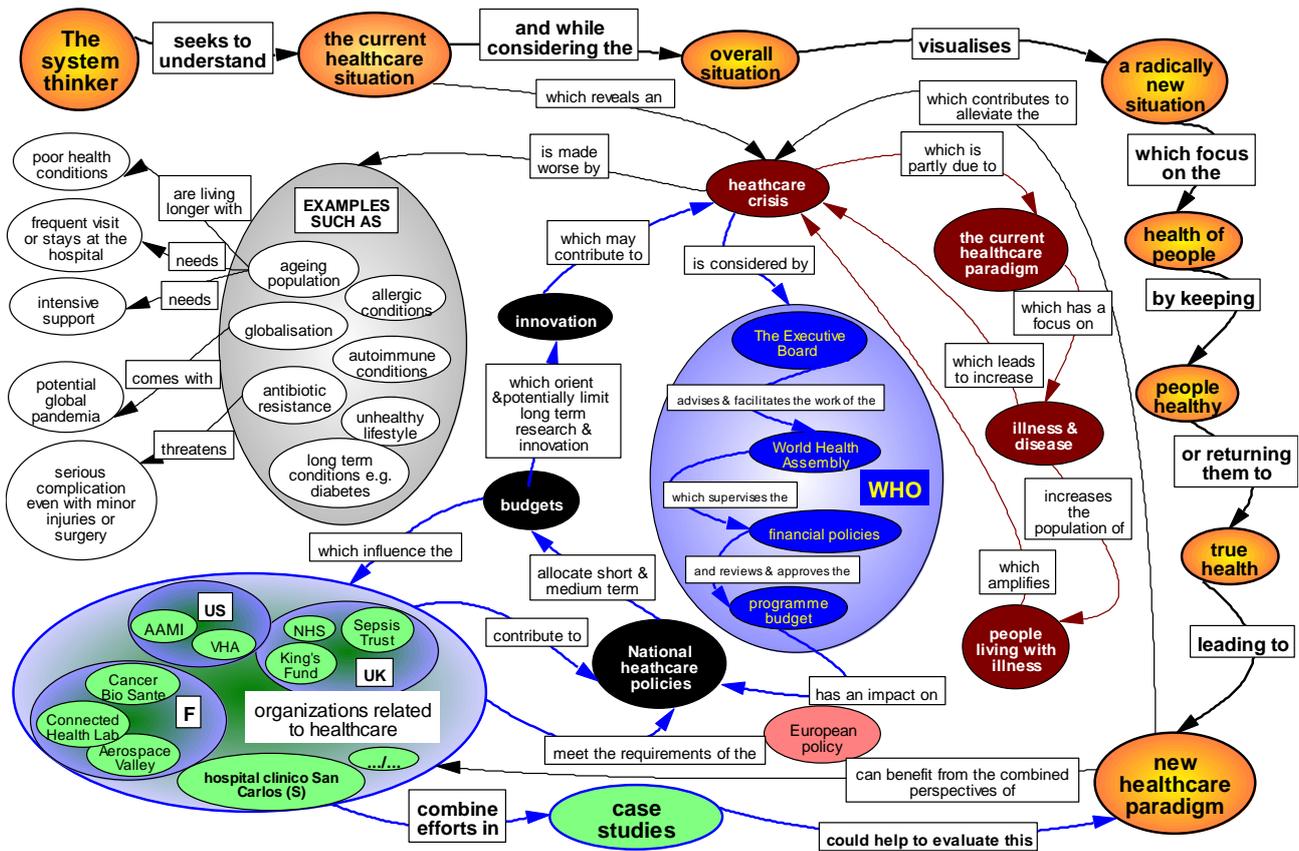


Figure 2. Example of healthcare Systemigram – a system conceptualisation

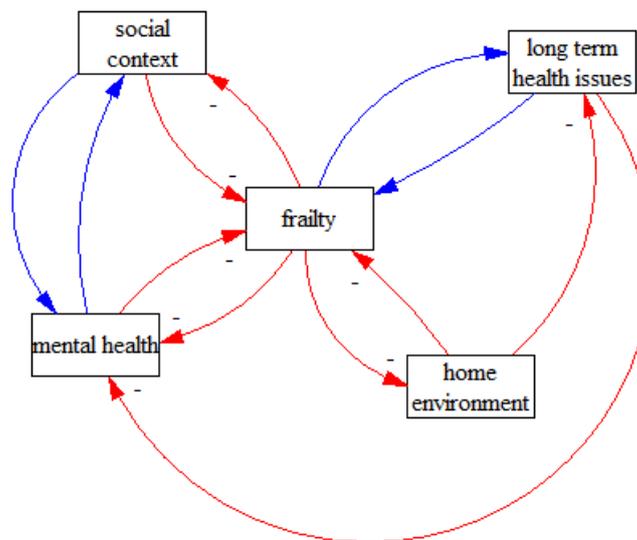


Figure 3. Causal Loops evident in explanation of Frailty context

Using a technique promoted to INCOSE and the International Society for the Systems Sciences (ISSS) by Sue Gabriele (Gabriele 2014), each stream kicked off with a round table. The basic guidelines provided by Gabriele were made specific to [issues, opportunities, actions], to reflect ‘the good, the bad and the ugly’ framework above. Each roundtable session was time-boxed, and with 2-minute slots for each attendee to give their view on an issue or opportunity in the topic being tackled. The guidelines included information to support listening, speaking, and responding. Each session

either ended at the time box limit, or when all contributions were exhausted. The facilitator recorded items on flip charts for discussion / analysis.

What became clear as the roundtables progressed was that everyone was keen and passionate to make a difference in what was obviously a highly complex and exceedingly challenging environment, fraught with problems. It was evident during the round table process that people really were listening to what others were saying and that this was informing their own thoughts as they voiced their opinions. The sense that came across very strongly was a real willingness to better work together on a common goal. Mutual acceptance and realisation of this was shared across the participants and helped to establish a shared mind set. Afterwards people commented on how useful it was for the participants in the roundtable to repeatedly say their names as part of the process because most attendees were not previously known to each other. This roundtable technique gave each participant equal time to share their perspectives regardless of seniority and genuinely contributed to increasing social familiarity and cohesion within the group.

Although the account below focusses on Stream 2 and the use of the roundtable technique, other techniques were also applied in other streams, including: N-squared charts (Hitchins 2003) for exploration of organisational communication); concept mapping (Moon 2011) for organisation structure; for concepts underlying frailty domain).

### ***Example - Stream 2 – examining organizational complexity***

This stream pursued two questions, as follows.

Question 1: What are the main stakeholder organisations? What Interactions do they have that create challenges? The purpose of this was to start to build up a structure of the main components of the situation system and to start to understand the complexities of the interaction.

Everyone contributed to identification of these main components on post-it notes. It quickly became evident that there was a lot (40+) organisations spanning governance, education, providers and commissioners, patient bodies/community groups. It became apparent the difficulty that the participants had in understanding the healthcare system due to the complexity of the organisations and simultaneously the duplication/overlap and gaps in responsibility. When patients enter the healthcare system they are often rapidly sucked into escalation pathways (Primary->Secondary->Tertiary). Rather than best using resources and capabilities that might be available if they are a) known about and b) accessible, the take-away message is: organisational complexity is leading to ineffective and inefficient healthcare. When primary care is needed and initiated, the “best” pathway is not always enacted. A second stream, having revealed that inter-organisation communication was a challenge, specifically investigated this topic, using an N-squared technique. The delegates were asked to cite examples of either a good, or a poor, interaction between a pair of organisations, good put onto green Postits, poor put onto red Postits. The outcomes revealed a very mixed picture as shown in Figure 4 below, the numbers counting up green or red examples. Some organisational units apparently show majority of positives, some many negatives, while yet others a mixed picture. Potentially such systematic collation of (even opinions on) the degree of good/poor communication between organisational units could be a useful tool in improving interfaces between units; more work would be required to actually exploit and act on such inter-organisation communication issues.

Question 2: If you could work magic, what would the ideal organisation look like? The feelings and ideas of the participants suggest the following is needed (selected subset only listed here):

- A good balance of generalists and specialists. (Too much emphasis on specialist at the detriment of the “glue” that holds things together)
- Staff rotation (to develop wider skills and perspectives) is to be encouraged. (Must be balanced with the need to maintain strong teams with not too much turnover)

- Roles to be sufficiently attractive and rewarding – (turnover / recruitment is a big issue)
- Fewer inappropriate silos (too much internal competition, compromise use of resources)
- The need for one “virtual” (if necessary), healthcare organisation, with known roles and responsibilities clearly linked to contribution to the whole.
- We need to better focus on what is right for the patient – responsive, adaptable, timely, making the right decisions for them, not for the department.
- Governance funding is necessary, but this needs to be linked to appropriate spending in actual healthcare delivery (impression is spending is not always linked to delivery)
- When we consider new structures we need to think outside of our existing experience, e.g. better neighbourhood services (Polyclinics), new roles (Advanced Nurse)

Value in each cell is the sum of positive statements and negative statements where positive are assigned +1, negative are assigned -1. Refer to other sheet "pivot incD transposed" to understand number of statements that have contributed to a final the number.

	1. Shropshire Community Health Trust	2. RSH	3. British Red Cross	4. Age UK	5. GPs	6. Telford PRH	7. SaTH	8. Telford / Wekin CCG	9. Shropshire CCG	10. Local Authority – Telford	11. Local Authority - Shropshire	12. SHROPOC Out of Hours	13. West Midlands Ambulance Service	14. Powys Local Health Board	15. South Staffs Mental Health	16. Hospice	17. Wales Ambulance Service	18. SPIC (Providers)	19. Outside-Region Hospitals	20. Fire Service	21. Health Education England
1. Shropshire Community Health Trust	1	1	0	1	2	2	2	2	0	2	1	1	-1	1	3	2	-1	-1	0	0	1
2. RSH	2	1	0	2	1	1	1	2	0	-2	2	1	-1	0	2	2	-1	-1	0	0	0
3. British Red Cross	3	-1	1	1	1	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1
4. Age UK	4	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. GPs	5	-1	0	0	-1	0	0	0	0	-2	0	2	-1	1	0	0	0	0	0	0	-1
6. Telford PRH	6	0	0	0	0	0	1	1	0	0	0	0	0	-1	1	0	0	0	0	0	0
7. SaTH	7	-1	1	1	-1	0	0	0	0	0	-1	0	0	-2	2	0	0	-1	-1	0	-1
8. Telford / Wekin CCG	8	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9. Shropshire CCG	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10. Local Authority – Telford	10	0	-2	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11. Local Authority - Shropshire	11	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12. SHROPOC Out of Hours	12	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
13. West Midlands Ambulance Service	13	-2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14. Powys Local Health Board	14	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15. South Staffs Mental Health	15	0	0	0	0	1	1	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
16. Hospice	16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17. Wales Ambulance Service	17	0	0	0	0	0	1	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
18. SPIC (Providers)	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19. Outside-Region Hospitals	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20. Fire Service	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21. Health Education England	21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4. N-square diagram illustrating nature of communications between organizational units

Organisations/departments are not always doing what they should be doing and are “passing the buck”. Risk aversion is a factor, also not enough skilled staff, recruitment and retention being a key issue, systems, including measurement systems, are not helping and often hindering.

The top three things in the “need to do” were:

1. Focus on what is best for the patient and personal health. Not what is best for the organisation, process is an enabler, not the purpose.
2. One team – common vision, understanding of contribution, purpose and belonging to the whole, common data and information.
3. Situational awareness /planning ahead – new resources and capabilities, realistic plans; constant policy change is not conducive to making progress in transformation plans, some stability is needed to effect planned change.

**Preparation for Workshop 2 (WS2) :** One preparation from WS1 in support of WS2 and beyond the N-squared communication visualization was to simply show an organization diagram, not

however as a conventional organigram, but as a class diagram, as shown in Figure 5. Here the ‘leaf’ organisations that were specifically involved in WS1 are shown in white, while the ‘higher level’ organisational units (such as NHS or Voluntary placeholders) are shown in yellow. It becomes easier to understand how navigating the healthcare organisations, even for professionals, can be a challenge!

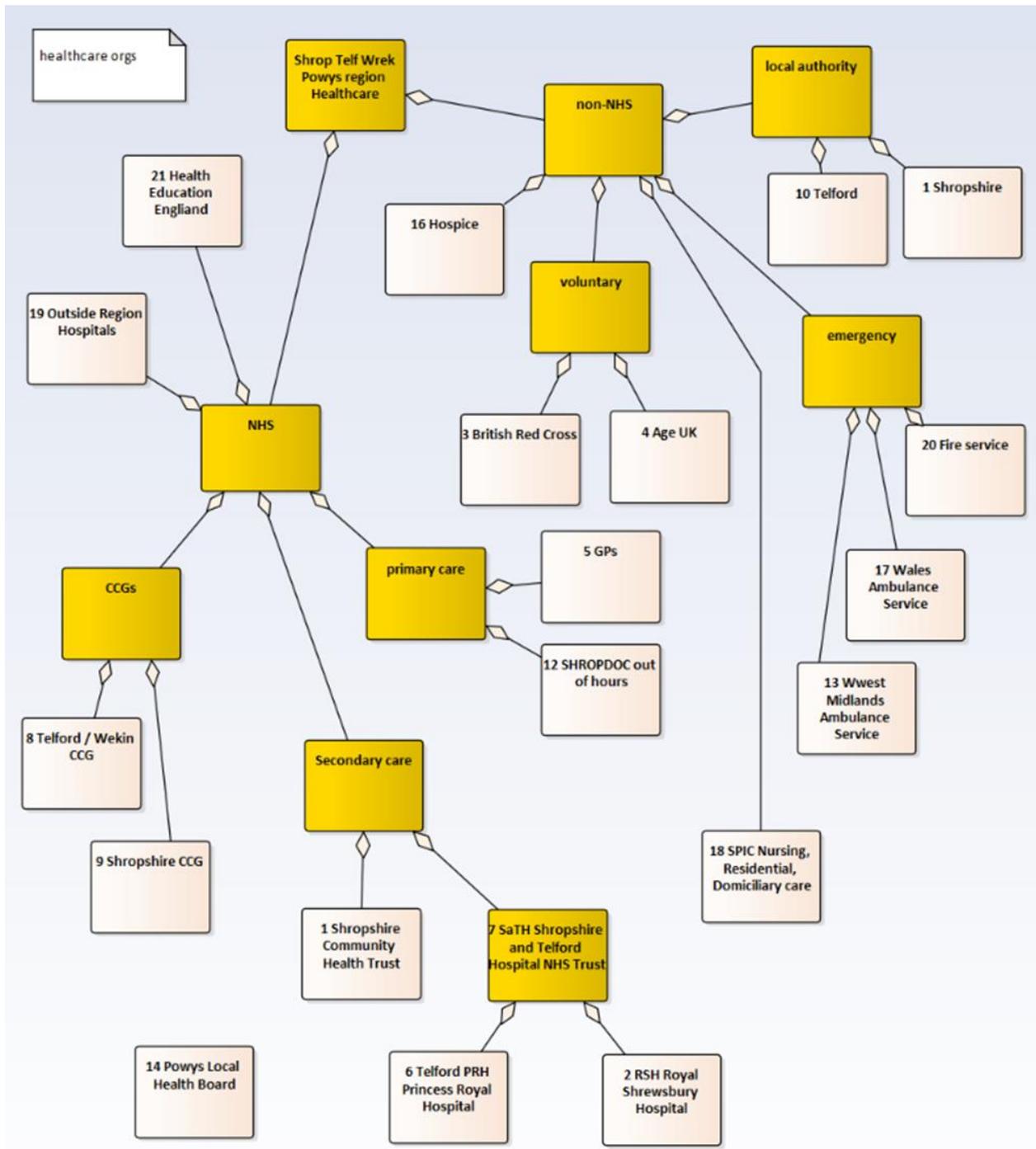


Figure 5. Organisational class model

A second visualisation focused around the Frailty topic, using the same source as used previously for the causal loop diagram, was a visualization of the concepts for Frailty. This diagram is shown in Figure 6 below. Although this specific material has not been exploited beyond improved communication in the workshops, techniques such as this have potential to review conventionally-written materials around Frailty for consistency and clarity.

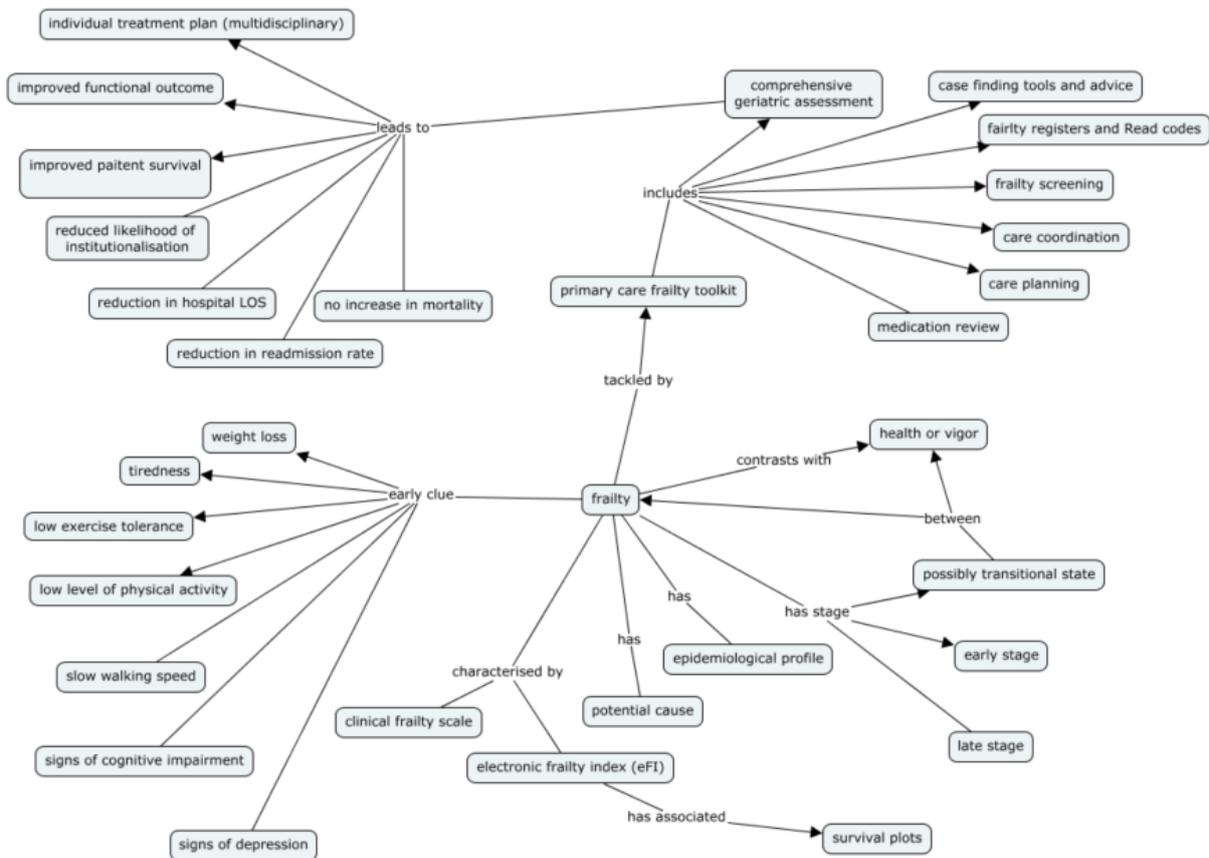


Figure 6. Concepts around definition, stages, early clues of, and toolkits for Frailty.

The emerging complex socio-technical system that emerged from the referenced materials above and the WS1 led to application of techniques to explore the dynamics of organisations, such as Systemigrams (Boardman 2013) and causal loop modelling using Causal Loop Diagrams (CLD) (Anderson 2015), in preparation for WS2.

Figure 7 below illustrates a Systemigram focussed around the typical ‘pathway’ encountered by a frail individual, partly inspired by the excellent account “Mrs Andrews Story”, at (HSJ 2014). The Systemigram (in contrast to a CLD) essentially ‘tells a story’. So for instance, this is a graphic depiction of a number of activities and events: “A frail yet relatively independent person ends up in hospital after a fall. They are sore and stiff. The doctor wants information [to diagnose any issues] so orders diagnostic tests which often cannot be done on that day so they receive hospital care, [so continue to] sit or lie, which makes them [more] sore and stiff...”. Such a diagram, with additional animation, proved immensely useful at Workshop 2, and its value cannot be underestimated.

**Workshop 2 (WS2):** WS2 focussed on refining issues from Workshop 1, and principles and goals for improved healthcare around Frailty. Systemigrams helped the different players that come into contact with a frail individual (GPs, paramedics, A&E staff, Ward staff, consultants, social services...) to see ‘the bigger picture’. This is in real contrast to the typical ‘silo’ perspective. It also helps to encourage not only a more integrated view, but reveal opportunities for ‘left shift’ – for instance, enabling more rapid reaction to an admission by having patient medical, social context, and wishes readily to hand. The diagram of Figure 7 was used live in the workshop to collate further issues with current processes, or opportunities for improvement.

Causal loop diagrams were also used, Figure 8 shows an example. Again inspired by the Mrs Andrews video, this illustrated factors around Frailty that can reduce the likelihood (unless medically necessary) of moving to the next stage in the typical healthcare pathway. Simply being aware of

factors such as the negative effect of reduced activity leading to more ‘decompensation’ (muscle weakness) and of the need to encourage appropriate exercise, can affect dynamics in the pathway.

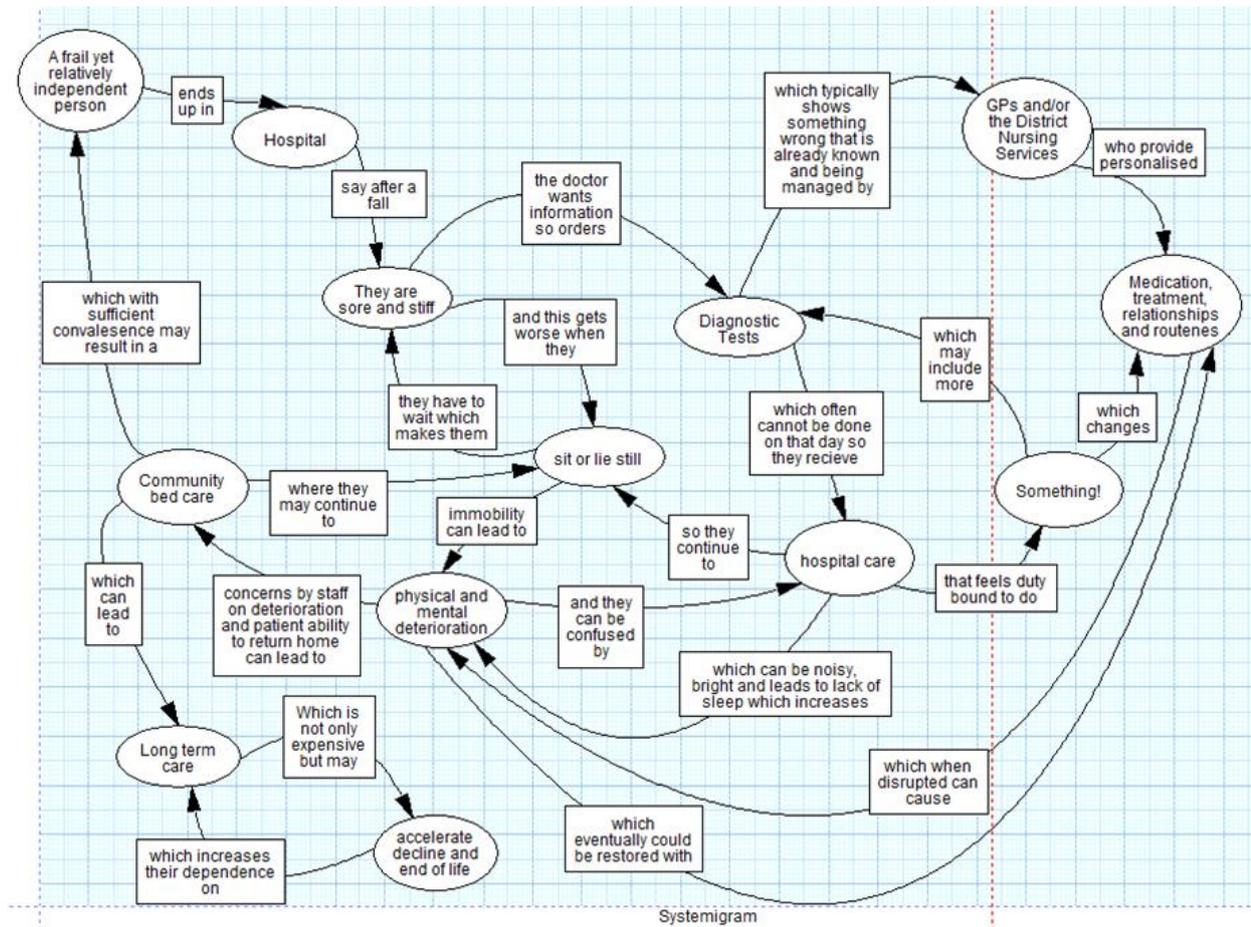


Figure 7. Systemigram focussed on a typical frail individual’s encounter with healthcare

These visualizations were used in the workshop to act as focus for discussion, and to collect further (and validate existing) issues and suggestions for improvement. The outcome from WS2 was an organized collation of over 60 issues, and ~100 proposals. Proposals were categorized into five different categories, as shown in Table 1.

Table 1: List of proposal categories

Category	Explanation
PersonFocus	Focus on what is best for the frail individual, delivered through timely personalised medical and social care
OrgIntegration	Single cross-cutting culture and organisation with effective information-driven resource/capacity planning
InfoSharing	Common information on a frail individual understood, accessed and used across the enterprise
DecisionMaking	Decision-making and care pathways to be world-class, rolled out and consistently used
TechExploitation	Cost-effective use of assistive technologies to support the independent, frail, individual

The distribution of these proposals versus these categories is shown in Figure 9 (a) below.

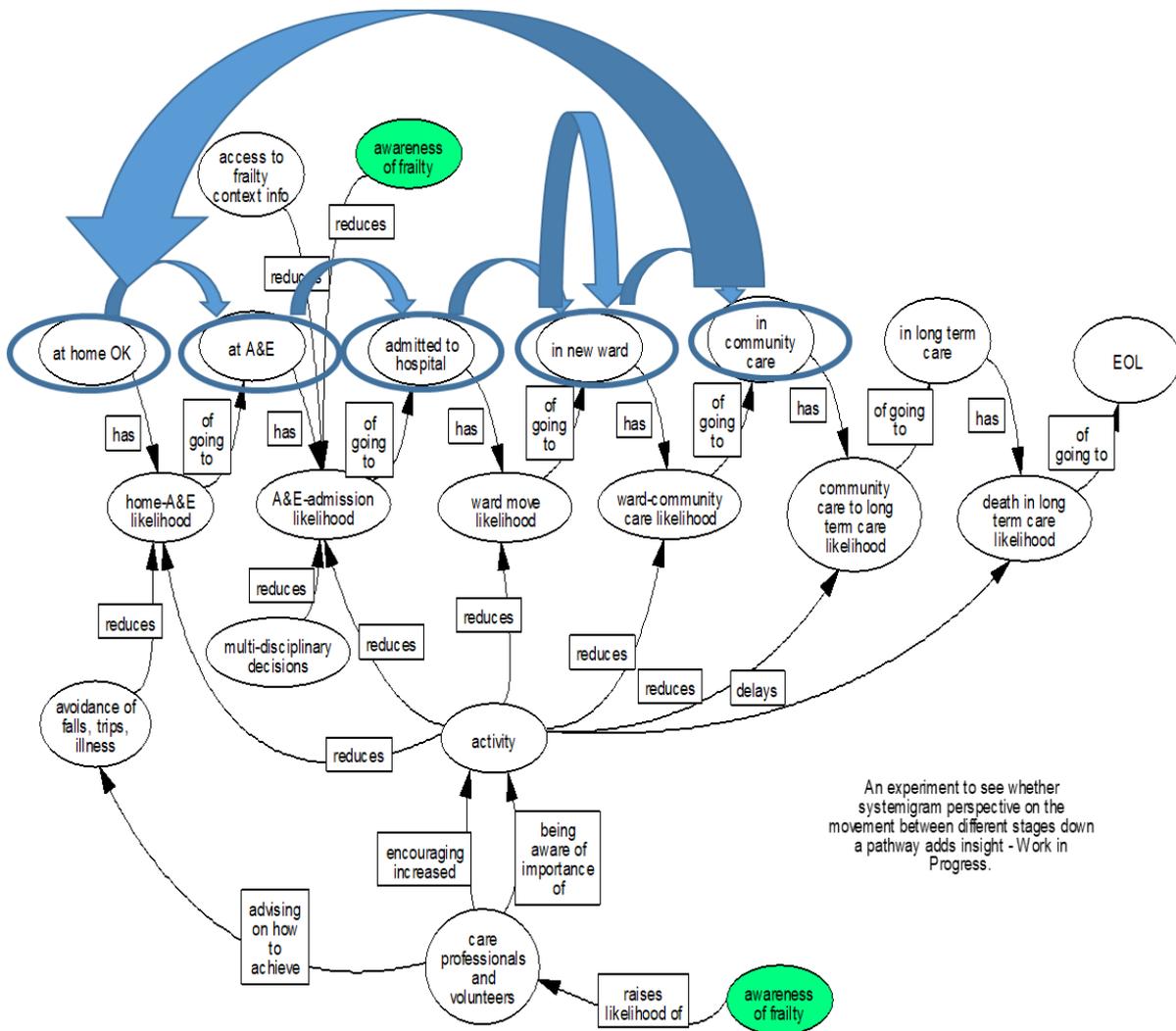


Figure 8. Causal Loop diagram illustrating effects on stage-to-stage likelihoods

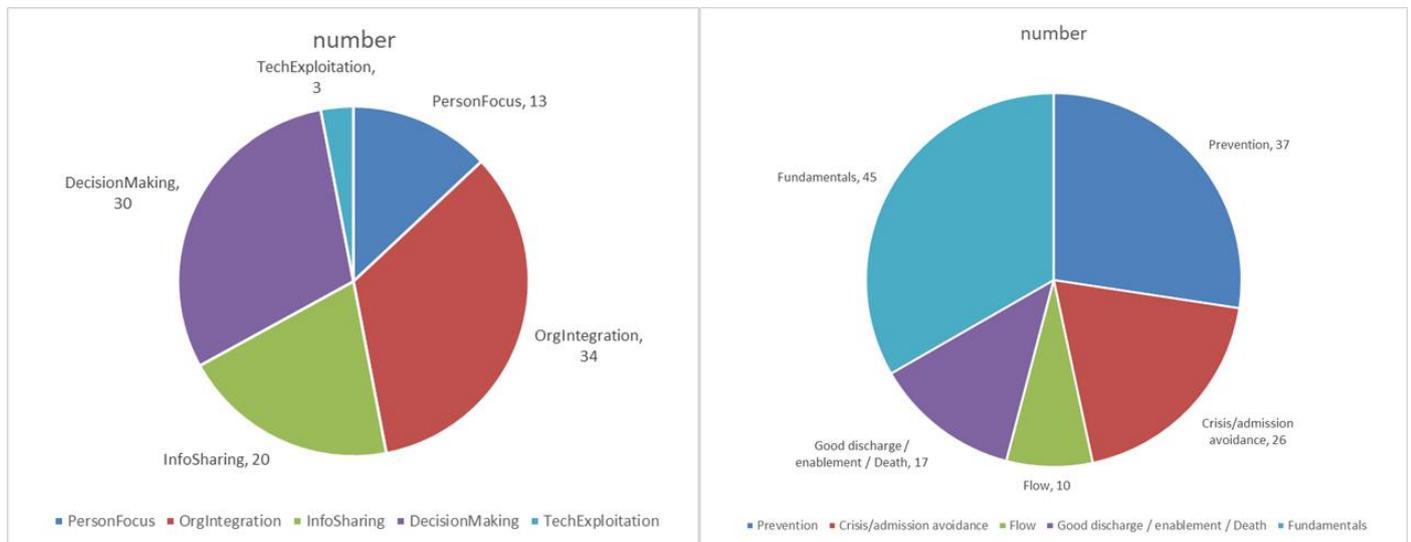


Figure 9. (a, left) S2 outcome proposals, categorized, (b, right) Distribution of proposals versus Frailty pathway stages

**Preparation for Workshop 3 (WS3) :** Workshops 1 and 2 had produced much tangible material on issues, and opportunities, and less-tangible, but equally important advances in good cross-disciplinary

understanding of pathways, work practices and the need to avoid operational silos. An area that was prompted towards the end of WS2 was that of ‘the ideal’, what does good look like? The attendees were prompted to provide ‘3 wishes’. These were collected, merged into previous material and collated, and formed a body of information of 136 improvement proposals that were considered during WS3. The proposals were also categorized broadly into the four phases of the frailty pathway – Prevention, Crisis / admission avoidance, [maintaining] Flow, Good discharge / enablement / death – and a fifth category – Fundamentals – for cross-cutting aspects (such as improved information sharing). The distribution of the proposals across these categories is shown in Figure 9 (b). Note the high number of Prevention proposals, representing a realization of the ‘shift left’ philosophy: do what you can to actually minimize Frail persons actually needing to go to A&E in the first place (for instance advice on minimizing falls at home, etc).

**Workshop 3:** The third Workshop built on outcomes from WS1 and WS2 and systematically collected views on qualitative costs and benefits of various suggested improvement actions collated from WS1 and WS2. This enabled clarity on potential benefits, and a systematic view of phased implementation. All proposals were assessed by the group, with each person giving a number between 0 (low) and 3 (high) against each of the criteria: how valuable, how costly, how difficult. Figure 10 indicates outcomes of this prioritisation technique across all proposals for ‘left shift’ (‘prevention’) based on these simple collective estimates of benefit, cost and difficulty. Figure 11 illustrates some of the emerging proposals mapped to the Systemigram frail pathway after Workshop 3.

Finally, WS3 included the suggestion, following the prioritization activity, to orient the Proposals into three phased Projects representing respectively: (1) short term, substantial early benefits; (2) medium term, addressing more complicated topics requiring design in 2017 and implementation through 2018; (3) longer term, addressing complex topics. Figure 12 below illustrates this outline scheme.

Source	statement	capability	lifecycle phase	how good?	how costly?	how hard?
WS2	1) Assessment of (normal place or resident) home for falls risks, alarm system – could have avoided initial event holistic view	OrgIntegration	Prevention	32	24	21
WS2	3) Have a discussion with patient early on re (wrt) their views regarding advanced care planning (may mean different things to different stakeholders)	PersonFocus	Prevention	33	13	18
WS2	1) Home OK – unwell at home and frail. Decision to keep at home – what we need to support this person. CGA; MDT approach; team to respond quickly; POCT (ok to be frail)	DecisionMaking	Prevention	33	19	27
WS2	Introduce Palliative care registers with GP's/Nurses contribution; this information and input is needed at the beginning.	InfoSharing	Prevention	31	12	15
WS2	Promote principle, and practices, for tests to be done in community, potentially by nurses, and share info: something was already known and managed (assessment at home)	OrgIntegration	Prevention	30	21	17
WS2	7) Adopt a frailty index and link it to a directory of services identifies cohorts of population, e.g. end of care planning; standard index necessary, identify populations at risk, link to what could be done	InfoSharing	Prevention	32	14	21
WS2	10) Define and subsequent Perform Comprehensive geriatric assessment (by an integrated team) needs to be done by MDT, into a single assessment	DecisionMaking	Prevention	33	27	27
WL	Proactively de-prescribe medications which can increase risk of falls and confusion (based on outcome of Comprehensive Geriatric Assessment) and provide exercise and educational groups to prevent/reverse frailty (more positive outlook).	DecisionMaking	Prevention	30	15	14
WL	Support for Frail individuals to remain in their residential/nursing home. Wrap around medical, nursing, care support	PersonFocus	Prevention	32	21	18
WL	A dedicated team in the community. Actively managing a caseload of the highest scoring frailty patients and proactively completing CGAs and care plans before they are in an acute crisis. (prompted lots of discussion)	OrgIntegration	Prevention	13	33	31
WL	I wish we could identify frail people better and upload their anticipatory care plans onto Adastra (used by 111/999) so they bypass NHS Pathways and get put through to a properly resourced locally sensitive primary care hub instead.	OrgIntegration	Prevention	33	23	30

Figure 10. Prioritisation of proposed improvement actions, in this case for Frailty Prevention ‘left shift’ proposals

### Techniques used and benefits

Many techniques have been used through the workshops, ranging from those to get a group of diverse stakeholders ‘on the same page’, to elicitation of views around issues and proposals, to visualisations of concepts and interdependencies. Techniques have origins both in the systems engineering and systems thinking communities. Use of the techniques was also underpinned with straightforward information handling approaches to support information gathering, categorisation and prioritisation, using MS Excel. Table 2 summarises the techniques and their benefits

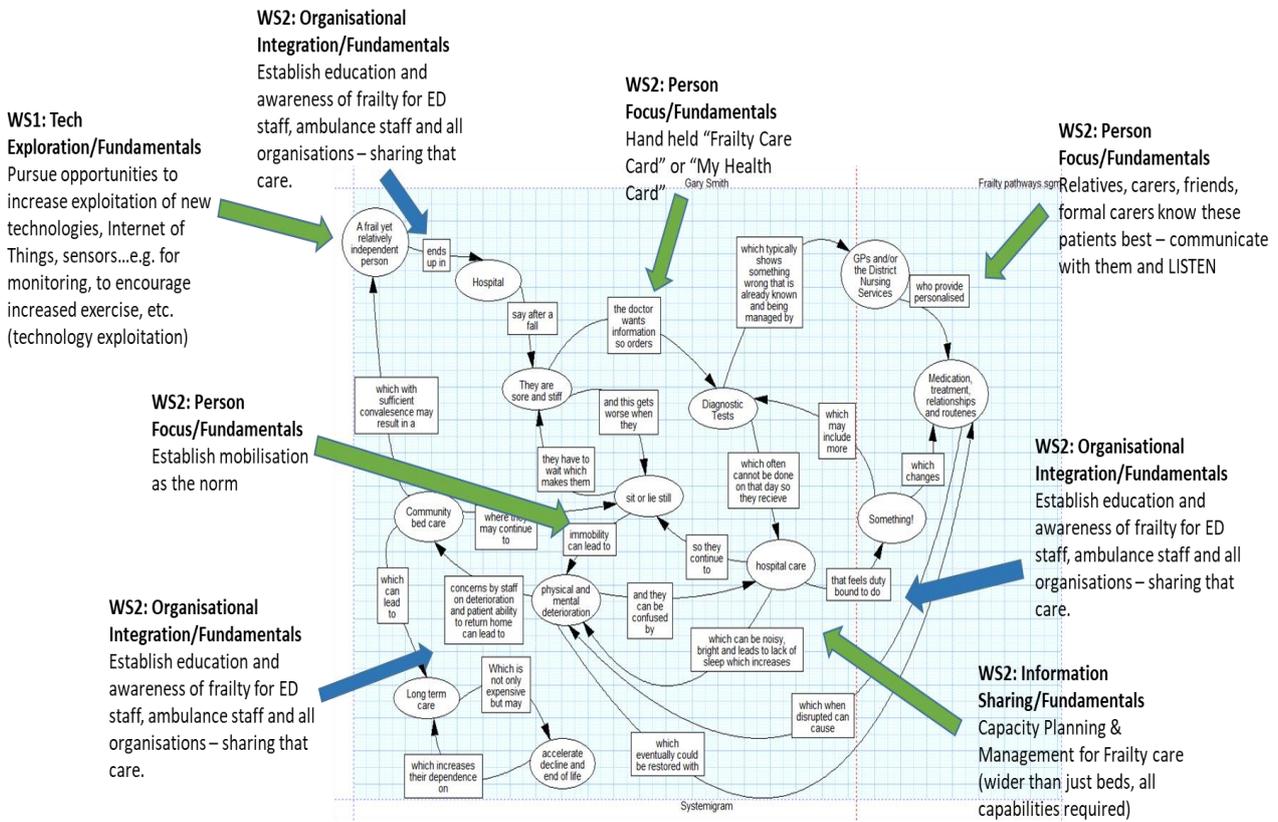


Figure 11. Proposals to establish foundations for new person-centred frailty approach

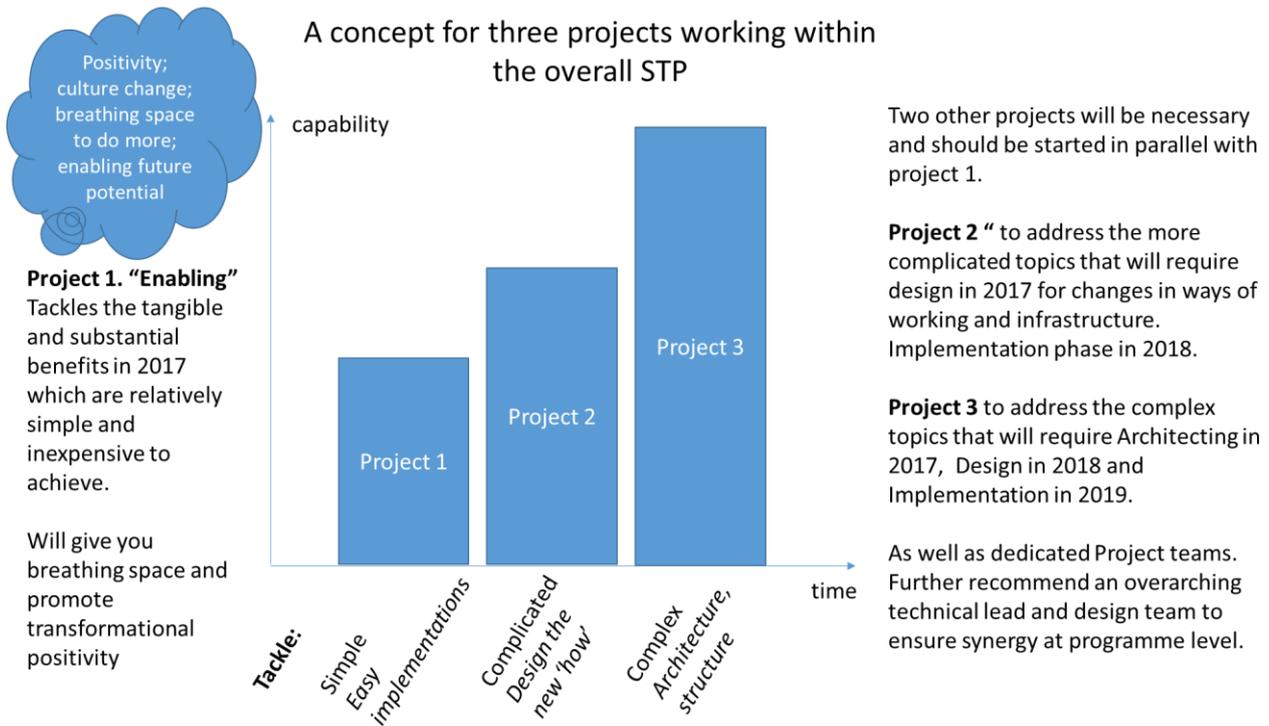


Figure 12. Three Phased Projects

Table 2: Summary of techniques and benefits

Technique	Purpose / Goal / Benefit
Round table	Gain individual views on [issues, risks, opportunities, solutions]; Everyone gets a voice; constrains ‘talkers’, hobby horses; People get to know each other
Systemigram	A concept visualisation that ‘tells a story’; once created, has a degree of intuitiveness
Causal Loop Diagram / model	Visualises qualitative relationships; can reveal supporting / opposing loops
Concept model	Visualises concepts, increases clarity, converges vocabulary
N-2 chart	Systematically capture and/or visualise interfaces between organisations; can identify ‘hot spots’, and even communication bottlenecks and potential weak points

Much of conventional healthcare improvement relies on approaches like Lean – elimination of waste in processes – where that technique is appropriate, and PDSA – Plan Do Study Act – cycles (see IHI 2017). The INCOSE SE contributed a strong systems perspective with techniques that usefully complement these traditionally used approaches.

## Results

The significant results of the work to date include:

- Widened perspectives from and for all stakeholders;
- A set of improvement proposals as a work programme traceable to issues and opportunities.
- Such a Work Programme forms a potential contributor to, and realisation of achieving the aims and objectives of, the STP.

The value of the INCOSE contribution to healthcare improvement is best represented by statements from the senior healthcare Executive ‘customer’:

*“I have found the support of INCOSE invaluable. We started the workshops with a considerable amount of information and knowledge but the facilitation skills and methodology adopted in each of the sessions helped draw out additional significant details previously invisible to partners. For example, we uncovered a cautiousness about mobilising frail patients to avoid falls on hospital wards. Sadly the impact was to exacerbate ‘de-compensation’ and mean the rehabilitation process was likely to take longer. NB 10 days bed rest for a frail patient = 12% loss of aerobic capacity (Kortebein et al. 2008). During the sessions we were able to unpack such examples and understand what fears underpinned behaviours and processes. The Systemigram analysis was particularly powerful and the diagrams produced have been used to share as a succinct summary of ‘what’s wrong now’ with system leaders.*

*These and other products from the INCOSE partners were extremely helpful in designing our solutions and agreeing priorities for the work we are currently engaging on. We are currently sharing the methodology with our new STP Programme Team and suggesting wider adoption of system engineering thinking for other elements of systemic working. Finally, the references to other systems outside health e.g. space travel and the airline industries (!) provided really helpful insight into common themes about how people behave in complex systems and relationships.”*

More specifically, the NHS can report that at the time of writing the successful adoption on one of the proposals, to have a Multi-Disciplinary Team (MDT) at the main hospital ‘front door’ (Accident and Emergency Reception of Royal Shropshire Hospital). The status from our ‘customer’ is positive:

*“The MDT would assess patients as soon as they arrived and wherever possible get them home with appropriate treatment/support either immediately or as soon as possible. They also started ‘tracking’ patients who were admitted so we could try to fast track their care and again discharge as soon as possible. After 3 weeks there were good results... [the MDT will] at least run for the winter [of 2017/2018].”*

From the INCOSE perspective, we are building useful experience in application of both SE and ST techniques to the healthcare ‘wicked problem’ domain, with the potential to add further to INCOSE materials and the SE Body of Knowledge (SEBOK).

## Conclusion and remaining challenges

It is clear from the feedback received both from the healthcare participants at the workshops, and from the senior managers following the workshops, that the facilitation by INCOSE representatives, the emphasis on understanding the ‘bigger’ cross-organisational picture and underpinning by the application of appropriate techniques has provided much benefit. The participants have a more coherent cross-organisational perspective, can see how adoption of many of the proposals the community suggested would lead to improved care for the frail community, and how a more integrated patient-centred health system could be realised.

A remaining challenge is how exactly to integrate / merge the outcomes of this frailty-focussed work with the overarching STP realisation programme. Our work continues with the NHS, a further workshop is planned to help support the kick off of transformation initiatives and we have further discussions arranged with the programme managers to discuss additional support. Any further activities may also allow the adoption of additional relevant techniques; one relevant area to consider is insights from Systems of Systems Engineering (SOSE) since clearly the health economy being explored exhibits many system of systems characteristics and so may benefit from insights in this area.

## References

- NHS (National Health Service), 2013, The NHS belongs to the people: Call to Action, <https://www.england.nhs.uk/wp-content/uploads/2013/07/nhs-belongs.pdf> accessed 18/6/2017
- NHS (National Health Service), 2014, Five Year Forward View, file NHS 5yfv 2014 Oct.pdf, available from <https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf>
- Moody, D., 2016, Frailty Fulcrum, <https://www.england.nhs.uk/2016/01/dawn-moody/>
- Gabriele, S., 2014, Round Table Guide (Introductory), <https://sgabriele.wordpress.com/4th-grade-roundtable-guide-introductory/> (last accessed 13/6/2017)
- HSJ (Health Service Journal), 2014, Mrs Andrews Story, <https://www.youtube.com/watch?v=I0TVbhHdg4A>, accessed 18/6/2017.
- Boardman, J., 2013, Systemic Thinking: Building Maps for Worlds of Systems, Wiley
- Anderson, V., Johnson, L., 2015, Systems Thinking Basics: From Concepts to Causal Loops, Pegasus Workbook Series
- Hitchins, D., 2003, Advanced Systems Thinking, Engineering, and Management, Derek Hitchins, Artech House, 2003.
- Moon, B. (ed.), 2011, Applied Concept Mapping: Capturing, Analyzing, and Organizing Knowledge, CRC Press
- IHI (Institute for Healthcare Improvement), 2017, PDSA tool, see <http://www.ihl.org/resources/Pages/Tools/PlanDoStudyActWorksheet.aspx>
- Kortebein, P., Symons, T.B., Ferrando, A., Paddon-Jones, D., Ronsen, O., Protas, E., Conger, S., Lombeida, J., Wolfe, R., Evans, W.J., 2008, Functional impact of 10 days of bed rest in healthy older adults, J Gerontol A Biol Sci Med Sci. 2008 Oct;63(10):1076-81.