

The effects of information technology networks on patient safety:
a realist synthesis

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Rebecca Randell is a member of the HS&DR Research-led panel. Roberta Longo was an HS&DR associate board members panel during time of the project. Justin Waring was a member of the HS&DR Research-led panel within 3 years prior to this project.

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Scientific Summary

Background

Many people who live in their own homes, and who have a number of health problems, need support from a range of health and social care professionals. These include general (or family) practitioners, community nurses, therapists, social workers and planned and emergency hospital services. There is good evidence that treatment and care is often fragmented, and increases patients' safety risks. Policy makers and opinion leaders argue that information technology networks that link organisations' systems together – often referred to as interoperable networks - can help to overcome the fragmentation, support effective co-ordination of services, and thus ensure safer treatment and care.

The networks might support safer services in two main ways. First, health and care professionals can use the networks to communicate securely with one another, and actively co-ordinate a patient's treatment and care. The value of this function might be particularly evident at transition points, for example in a health emergency or at the point of leaving hospital to return home. Second, different services have historically held their own records, and information about a patient's treatment and care held in one service could not be accessed by professionals working in others. The networks can be designed to enable professionals to search for and locate information wherever it is held, and use the additional information to provide better and safer treatment and care.

There have not, to date, been any systematic reviews of the effects of cross-organisational interoperable networks on patient safety. We conducted a realist synthesis, which sought to both to describe and explain the effects of interoperable networks on patient safety.

Aim and objectives

The aim of the study was to establish how and why interoperable networks improved patient safety, failed to do so, or increased safety risks. The objectives of the study were to:

- Identify initial programme theories, and prioritise theories to review;
- Search systematically for evidence to test the theories;

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- Undertake quality appraisal, and use included texts to support, refine or reject programme theories;
- Synthesise the findings;
- Disseminate the findings to a range of audiences.

Design

We undertook a realist synthesis. As with all realist syntheses, a key feature of the design was a comparison of the intended and actual effects of an intervention. The comparison provided a basis for explaining how the intervention worked, and why it was effective (or ineffective) in practice. The intervention of interest was interoperable networks that linked organisations across a health and social care economy. The outcomes were changes in patients' clinical risks, e.g. in medication reconciliation error rates.

Information about the intended effects of interoperable networks on patient safety was identified in statements in policy documents, opinion leader articles and other sources. These were used to develop programme theories, which together represented both how and why the networks were intended to work. We then conducted nominal group meetings with policy makers and with National Health Service information technology leads, and telephone interviews with frontline clinicians, to elicit their interpretations of the theories, and to establish their priorities for review. The main programme theory selected for detailed study focused on specific effects on the decisions and actions of professionals, and the consequences for patient safety. We also developed a mid-range theory, to be used as a source of independent judgement criteria in the evaluation phase of the synthesis.

A case study design was used to co-ordinate literature searches for empirical evidence about the actual effects of interoperable networks. Searches were undertaken in four domains:

- Older people living in their own homes who are in receipt of two or more services from different organisations
- Older people who are living at home and have been prescribed medications from two or more organisations

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- Children who are at risk of harm
- Economies of scope and scale of interoperable networks across health and social care organisations in a health economy.

A leading programme theory was tested and revised in each of the first three domains (within-domain evaluation). The designs of the searches in each of the three were very similar, allowing us to compare and contrast findings across domains (cross-domain evaluation). The fourth domain was different in kind to the first three. It was designed to evaluate an alternative programme theory, based on the argument that information technology networks can generate 'global' effects across all users. The literature searches were, accordingly, distinct from those used in the first three domains. The common and contrasting findings were then further reviewed against the mid-range theory, enabling us to assess the extent to which the revised programme theory might be generalised to other information technologies and settings.

Patient and public involvement

The patient and public involvement group met three times in the course of the study, and contributed to its design and conduct on each occasion. At the first meeting we presented the early findings of our theory development searches and the nominal group meetings. The patient and public involvement group provided valuable comments, in particular in helping us to set priorities for the populations and settings that we should focus upon. It was their comments, taken in tandem with the views of the nominal groups, that led us to focus on services for frail older people living at home (later broadened, pragmatically, to older people in general). They also noted the importance of medication reconciliation, and expressed the view that the next most important population to study would be at-risk children. We acted on all three of these comments.

At the second meeting we presented interim findings of the first two sets of searches, on the co-ordination of services for older people and on medication reconciliation. The group gave their comments on, and interpretation of, those findings. The third meeting was used to comment on drafts of the Discussion and Conclusions chapter and the Plain English Summary.

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Results

In the theory development phase of the synthesis, we did not find any detailed accounts of the ways in which interoperable networks are intended to change the behaviour of professionals, and by extension improve patient safety. There were many statements to the effect that treatment and care would be safer, but the majority did not attempt to explain in any detail how or why the improvements would be achieved. We were, though, able to identify a substantial number of theory fragments, and used these to develop initial rough programme theories. We were also able to identify a mid-range theory, which framed – provided a broad theoretical framework for – the interpretation of the evidence about the programme theories. The mid-range theory was institutional in nature, emphasising that technology developments and working practices shape one another over time.

The co-ordination of services for older people

We found substantial evidence about the nature and extent of care co-ordination problems. Most of the problems were essentially social or cultural in nature. For example, there were several evidenced-based reports of difficulties due to different healthcare professionals having incompatible working assumptions about the kinds of support that older people needed. There was no obvious role for interoperable networks in solving most of these problems. There was one exception, which concerned difficulties associated with information seeking and retrieval. The problems were attributed to a combination of inter-professional issues – not directly related to technology – as well as characteristics of the networks (such as multiple log-ons) and the difficulty of locating patient information held on other organisations' servers. We did not find any countervailing studies which reported 'seamless' use of interoperable networks.

There was limited and weak evidence about the effectiveness of interoperable networks in reducing older peoples' risks. The evidence was for limited networks, typically involving a single application (such as a shared assessment process), and based on the subjective views of users. We did not find any quantitative patient-focused measures of effectiveness.

The co-ordination of medication reconciliation

We found limited empirical evidence that there is a problem with the process of conducting medication reconciliation. The available evidence suggested that medication reconciliation problems could be due to the fact that responsibility for reconciliation was not clear on the ground, and could fall between professionals (principally pharmacists, doctors and nurses).

Another search investigated the nature of problems encountered in reconciliation when using interoperable networks. We found one observational study, and seven further 'offline' simulation studies, about the nature of clinicians' cognitive processes, and the error rates associated with them. These suggested that errors could occur in both types of reconciliation. There was less field-based evidence about users' experiences in this domain than in services for older people or child protection services.

A search focusing on evidence about changes in patient outcomes produced mixed results. Some articles indicated that the use of an interoperable network was associated with a measurable reduction in reconciliation errors. Others reported problems with using systems, resulting in interoperable networks having no effects on reconciliation error rates.

Child protection

We found evidence that there are co-ordination problems in child protection services. There is a debate in the academic literature about the nature of those problems. In the context of this synthesis, the key difference is that some commentators interpret the problems in mechanistic terms – as communication failures – while others argue that the problem reflect deeper inter-professional and inter-organisational problems.

There is some evidence that users find interoperable networks difficult to use – relatively, less than we found for the co-ordination of services for older people. We did not find any evidence about the effectiveness of interoperable networks, defined as changes in childrens' risks of harm.

Economies of scope and scale

We did not find any evidence of effects attributable to the effects of interoperable networks on health economies.

Limitations

The study had four main limitations. First, we found little evidence of outcome changes. We were not, therefore, able to determine 'what works', nor any variations in what works, when interoperable networks are deployed and used. This point is linked to the second limitation, which is that we used a case study method to evaluate interoperable networks in the three domains and in terms of economies of scope and scale. Taking the two together, we can say that we have been able to address broad questions about the nature of the co-ordination problems in the chosen domains, and practical experiences of using interoperable networks. We were not, though, able to produce fine-grained evidence that would allow us to evaluate our programme theories in detail.

Third, we developed and used a mid-range theory. The theory provided an independent, statement against which the relevance of articles could be judged. A disadvantage of the mid-range theory, we have found, is that it has risked locking us into the assumptions underpinning that theory. It would have taken a great deal of time and intellectual effort to move to another theoretical framework. We were able to use the mid-range theory to interpret our data – but in principle another framework might in principle do equally well, and we have not tested alternative theories for their 'fit' with the data. Fourth, we deliberately biased our choice of domains, in favour of services where we were most likely to find evidence of effects. We therefore have to be cautious about generalising from our findings to other domains.

Conclusions

The conclusions from the realist synthesis are that:

- There is good evidence that there are problems with the co-ordination of services in each of the three domains studied;

- There is evidence across the domains that professionals have found interoperable networks difficult to use;
- There is no evidence of economies of scope and scale across health economies;
- There is insufficient evidence about the effectiveness of interoperable networks to allow us to establish how and why they affect patient safety.

Future work

There are three implications for practice:

- Practitioners, including informatics and information leads, should note the lack of evidence about the effectiveness of interoperable networks, and take steps to monitor the effects of local programmes themselves;
- They should take note of the negative evidence about users' experiences of using interoperable networks;
- They should also be aware of the extent to which institutional arrangements, and in particular the challenges of working across professional and organisational boundaries, influence the deployment and use of interoperable networks.

The priorities for future research are:

1. Primary empirical studies of the effectiveness of interoperable networks in health and social care;
2. Primary empirical studies of economies of scope and scale associated with interoperable networks in health and social care;
3. In the course of this synthesis we came across a literature on patients' access to their records via interoperable networks. A synthesis focusing on patient portals would complement the synthesis reported here;
4. More detailed guidance on the design and conduct of realist syntheses, updating current RAMESES guidance.

Study registration

The realist synthesis is registered with PROSPERO, number 2017:CRD42017073004

First Look Draft

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