Electronic health records in ambulances: the ERA multiple-methods study

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Disclaimer: This report contains transcripts of interviews conducted in the course of the research and contains language that may offend some readers.

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Scientific summary

The ERA multiple-methods study

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Scientific summary

Background

Ambulance services have a vital role in the shift towards the delivery of health care outside hospitals, when this is better for patients, by offering alternatives to transfer to the emergency department. For non-conveyance to happen safely and effectively, ambulance clinicians must be able to decide which patients will benefit from being treated at the scene or left at home, and ensure that patient information, including details of 999 assessment and care, is passed on to community-based care providers.

Ambulance clinicians' decisions need to be well informed (supported by all relevant information), and they need to be accountable for them (the decision and the reasons for it need to be recorded). The introduction of information technology in ambulance services to electronically capture, interpret and store patient data can support out-of-hospital care. Electronic health records and other digital technology in ambulances have been encouraged by national policy across the UK since at least 2002. Roll-out has proved complex, with major workforce implications. Previous studies of the implementation of new information technology in other health-care contexts, including ambulance control rooms, tell us that it is not always straightforward to bring technology into use in health care: technology may not produce the expected benefits, staff may devise adaptations or workarounds and costly projects are sometimes abandoned. Electronic health record use, workflows and service redesign are unavoidably interlinked.

Objectives

We aimed to understand how electronic health records can be most effectively implemented in a pre-hospital context in order to support a safe and effective shift from acute care to community-based care, and how potential benefits can be maximised. Our objectives were to:

1. describe the current usage of electronic health records and associated information technology in ambulance services in the UK –
    i. to describe processes of implementation, uptake and usage
    ii. to investigate what use is currently being made of electronic health records in terms of identifying and managing repeat callers, information transfer to other providers, linking with other electronic resources (e.g. for decision support and referral), and research and audit
    iii. to investigate the use and development in ambulance services of other handheld technologies (including applications) to support decision-making and referral to community-based care
2. understand how the ambulance workforce responds to the introduction of electronic health records and associated infrastructure, and what impact electronic health records are perceived to have on the role of ambulance clinicians
3. investigate risks, benefits and unintended consequences of the implementation of electronic health records, in terms of changes to patient care, working practices of ambulance clinicians, management and organisational practice within ambulance services, and planning and commissioning processes in the wider health economy
4. understand the factors that lead to the successful implementation of electronic health records and adoption by the workforce, and how risks can be minimised and benefits can be maximised
5. assess the potential to further develop and implement electronic health records and computerised clinical decision-support and referral tools to support the shift to out-of-hospital care.

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Methods

We carried out a study with multiple methods, comprising four work packages. Work package 1 was a rapid review of the international, peer-reviewed literature on electronic health records in pre-hospital emergency care. We reviewed the scope of the literature, and identified key messages and questions to inform subsequent phases of the study.

Work package 2 entailed 22 semistructured telephone interviews with senior or middle managers across all 13 free-standing UK ambulance services (one or two interviews per service) on the state of their implementation of electronic health records, conducted from February to August 2017. Analysis drew on the framework approach.

Work package 3 consisted of four case studies on sites at different stages of implementation of electronic health records. We collated relevant background documents (business cases, minutes, etc.) in each site (20–59 documents per site). We observed use of technology in the field: 144 hours of observations, consisting of 12 observations of 12-hour shifts, with two to four observations per site. We carried out 30 interviews (six to eight per site) with relevant senior and middle managers and training staff, and with selected other stakeholders, including representatives of the commissioning or funding organisation(s), emergency departments and community health-care providers. We conducted 11 focus groups with paramedics and technicians (one to five per site). Fieldwork took place during April to October 2017. We obtained a 2-month snapshot (i.e. January–February 2017) of routinely collected quantitative data of calls and responses, covering 451,433 incidents and 307,676 electronic health records. To facilitate comparison across sites, we included a particular focus on three tracer conditions known to have potential for increased non-conveyance rates: falls in older people, diabetic hypoglycaemia and mental health crises. We analysed these diverse data and looked for cross-cutting themes, considering what variation and consistency there was across sites and why this might be. Analysis drew on the framework approach and included patient and public involvement representatives.

We presented a synthesis of work in the first three work packages to stakeholders in a knowledge-sharing workshop and associated activities, which made up work package 4.

Our study drew on theoretical principles in two prior National Institute for Health Research reviews, on the diffusion of innovation in health care and on the nature of electronic health records. In particular, we were informed by strong structuration theory with a technological dimension, which sets out a framework for studying innovation in terms of the key agent (in this case, the ambulance clinician), the political and organisational context, the technology itself and the recursive relationship between these elements in order to understand how new processes are, or are not, adopted in practice.

Results

Work package 1 found that, although there is an extensive and theoretically developed literature examining the implementation of technology into health care more generally, there is a very limited range of published literature specifically on electronic health records in ambulance services.

Work package 2 found that only half of the UK ambulance services had electronic health records in use at the time of data collection. A further two were in the process of implementing new systems and had reverted to paper systems in the interim. Of those using electronic health records, three were changing the system they used and one was planning to do so. Implementing electronic health records was neither a single event nor a linear process, and entailed ongoing negotiation between front-line clinicians and managers. Although there were challenges across the country, some services reported well-established systems. Respondents reported benefits to the accuracy of record-keeping and the ease of extracting data. However, many of the further advantages of electronic health records identified were yet to be realised.

In work package 3, although we had planned to observe four services at distinct stages of implementation, we discovered that the situation was more complex and fluid than this. One service was a long-established user of a tablet-based electronic health records system, one service was in the process of rolling out a second-generation system, one service was just completing roll-out of a tablet-based electronic health records system and one service was using a digipen-based electronic health records system while looking ahead to the future adoption of a tablet-based system. Although we saw some indication of data being transferred into and out of electronic health records systems to support patient care, none of these systems seemed to yet be being used to their intended potential.

Positive aspects observed included vision and enthusiasm from senior managers; front-line staff being open to new systems; benefits in terms of data quality, confidentiality, and efficient storage and searching for audit and medicolegal use. Challenges included difficulties with interoperability, technical issues and the need to update systems (software and hardware) without undue disruption.

Our analysis of routine data sets found variation between sites in fields and priority categorisation systems. Levels of electronic health record creation at the time of the data sample ranged across sites from less than one-third of calls to more than 99% of calls. Factors associated with a lower rate of electronic health records completion included the call being received within routine working hours, the call being categorised as low priority, the patient not being conveyed and a mental health condition being the reason for the call. In one site, we found strong associations between completion rates and which hospital the patient was conveyed to, but this service was still in the process of roll-out of a new electronic health records system.

In work package 4, stakeholders attending the workshop felt that the findings resonated with their own experiences, and found it valuable to share knowledge with others. Discussion groups identified the need to present front-line staff with the optimum software, the value of empowering staff by providing feedback on patient outcomes, the multifunctional potential of electronic health records devices, the need for information handover at the emergency department to be simple and streamlined, the role of a single point of ownership in the organisation and anxieties about data currency.

Looking across the work packages, the themes that emerged were:

- Digital diversity. There was no standard hardware or software in use, with great variation in how (and if) other technology and record systems were linked to the electronic health records.
- Constant change. Services were often transitioning from one system to another, from one supplier to another. When they were not, there were software and hardware updates. There was even switching back from electronic systems to paper records.
- Imperfect information. In real patient encounters, clinicians are likely to be dealing with partial or unclear information, which does not arrive to them in a pre-ordered sequence.
- Indirect input. Some patient data can be fed straight into the electronic health records, but data entered by clinical staff is still sometimes written on a glove or notebook, or just remembered, before being entered into the electronic health records.
- Data dump. The primary function of electronic health records in all services seemed to be as a store for patient data. There was, as yet, limited evidence of electronic health records' full potential being realised to transfer information, support decision-making or change patient care.
- The system is bigger than the service. To realise all the benefits of electronic health records requires engagement with other parts of the local health economy and dealing with variations between providers and the challenges of interoperability.
- Different data demands. Clinicians and data managers, and those roles in different parts of the health economy, are likely to want very different things from a data set, and need to be presented with only the information that they need.
- 'Ford Fiesta, not a Ferrari'. Sometimes simple is best.

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The experience of electronic health records in ambulances has many similarities with the story of electronic health records in health care more broadly, but also reflects the particular context of being on scene and in a vehicle, and the particular roles of paramedics. The successful adoption and use of electronic health records systems requires a long chain of arrangements at macro (national policy), meso (trust adoptions) and micro (an electronic device retaining its charge) levels to work, and adoption is often not successful. The use of the technology is reflected by the context it is in, and, in turn, the technology leads to changed behaviour, some planned and some not.

Conclusions

Implications for health care

Living with change

Our findings suggest that the implementation of electronic health records in emergency ambulance services is not something that can be considered 'task and finish' but is a continuous work in progress. This requires a flexible and ongoing approach to managing change.

Managing ambitions

Although electronic health records are showing benefits, these benefits are not yet as wide as they could be. Realistic planning and an acceptance that change moves slowly will help to sustain what has been achieved so far and reduce the risk of disappointment or cynicism that might inhibit further progress.

Flexibility in data collection process

Although electronic health records may support standardised processes of clinical observation, data collection and clinical decision-making, there will remain uncertainties, fluidity and ambiguity in the information available to ambulance clinicians. Seeing mismatches between the requirements of the electronic health records and the data entered into records as something to be anticipated and planned for is likely to be more helpful than seeing them as failure in compliance.

Addressing the interoperability requirement

Ambulance services face challenges in working with their local primary, secondary and acute health-care providers, and with social care, in ensuring that patient data are transferred securely and appropriately to support patient care. This issue is clearly on the policy agenda locally and nationally, but skilled negotiation and priority setting will be required to achieve effective and productive real-time flow of patient information both into and out of emergency ambulance services.

Maximising the potential of electronic health records as a multifunctional resource

As well as being instruments of data storage, tablet-based electronic health records have the potential to act as a portal to the world of information, both on the internet and through secure local information databases. Maximising the ability of ambulance clinicians to readily access guidelines, clinical advice or local service directories will ensure that electronic health records devices get embedded in use and achieve maximum benefit.

Maximising use of electronic health records to support staff development

Feedback from electronic health records has the potential to support staff reflective learning and appraisal, especially if linked to data on patient outcomes following ambulance service contact.

Identifying streamlined data sets

Patient records transferred at the time of patient contact are most likely to be used and useful if they are focused and relevant to the receiving clinicians. A streamlined data summary for transfer at the emergency department, rather than the full electronic health records, might support this.

Coherence of perspective throughout an ambulance service

We identified some differences in perspective between different staff groups within ambulance services about the value and potential of electronic health records, with managers typically more enthusiastic. There may be scope for more mutually beneficial communication to strengthen effective implementation of electronic health records.

Recommendations for future research

- Ambulance services are collecting huge, potentially valuable resources in the form of routine data sets, but have very limited capacity to analyse them beyond routine audit and reporting. The research community should prioritise finding ways to work with ambulance services to maximise the opportunity these present. Ambulance services are likely to welcome this prospect.
- There is scope for useful qualitative work on how ambulance service electronic health records are used (or not) in the emergency department and how they could be used better. We identified this opportunity, both from the perspectives of ambulance clinicians (who often thought that they were not really being used) and from the emergency department staff (who felt that the records were not particularly useful).
- There is scope to examine patients' perspectives on records and record-keeping within emergency ambulance services to understand how these views and experiences may affect patient care.
- Electronic health records provide the potential to offer ambulance clinicians feedback on patient outcomes, if records can be linked to other data sets. There is scope to develop this and to evaluate the impact of such initiatives.

Study registration

This study is registered as Health and Care Research Wales Clinical Research Portfolio 34166.

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