Electronic Records in Ambulances: challenges, opportunities and workforce implications – a study using multiple methods (ERA)

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Conflicts of Interest

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Important

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A final version (which has undergone a rigorous copy-edit and proofreading) will publish as part of a fuller account of the research in a forthcoming issue of the Health Services and Delivery Research journal.

Any queries about this 'first look' version of the scientific summary should be addressed to the NIHR Journals Library Editorial Office – journals.library@nihr.ac.uk

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Scientific Summary

Background

Ambulance services have a vital role in the shift towards the delivery of health care out of hospitals, when this is better for patients, by offering alternatives to transfer to the emergency department (ED). For non-conveyance to happen safely and effectively, ambulance clinicians must be able to decide which patients will benefit from being treated at 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 are accountable for them (the decision and the reasons for it need to be recorded). The introduction of information technology (IT) in ambulance services to electronically capture, interpret and store patient data can support out of hospital care. Electronic health records (EHR) in ambulances and other digital technology has 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 IT in other healthcare contexts, including ambulance control rooms, tells us that it is not always straightforward to bring technology into use in healthcare: technology may not produce the benefits expected; staff may devise adaptations or workarounds; and costly projects are sometimes abandoned. Electronic record use, workflows and service re-design are unavoidably interlinked.

Objectives

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

1. To describe the current usage of EHR and associated IT in ambulance services in the UK:

    a. To describe processes of implementation, uptake and usage.

    b. To investigate what use is currently being made of EHR 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.

    c. To investigate the use and development in ambulance services of other handheld technologies (including apps) to support decision-making and referral to community based care.

2. To understand how the ambulance workforce responds to the introduction of EHR and associated infrastructure, and what impact they are perceived to have on the role of ambulance clinicians.

3. To investigate risks, benefits and unintended consequences of implementation of EHR, in terms of changes to patient care, working practice of ambulance clinicians, management and organisational practice within ambulance services, and planning and commissioning processes in the wider health economy.

4. To understand the factors which lead to successful implementation of EHR and adoption by the workforce, and how risks can be minimised and benefits maximised.

5. To assess the potential to further develop and implement EHR, computerised clinical decision support and referral tools to support the shift to out of hospital care

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 EHR 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 semi-structured telephone interviewers with senior or middle managers across all 13 free-standing, UK ambulance services (1-2 interviews per service) on the state of their implementation of her, conducted February-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 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, 2-4 observations per site. We carried out 30 interviews (6-8 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), EDs, and community healthcare providers. We conducted 11 focus groups with paramedics and technicians (1-5 per site). Fieldwork took place during April-October 2017. We obtained a two month snapshot (January-February 2017) of routinely collected quantitative data of calls and responses, covering 451,433 incidents and 307,676 EHR. 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 this 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 PPI 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 NIHR reviews on the diffusion of innovation in healthcare, and on the nature of EHR. In particular, we were informed by Strong Structuration Theory (SST) 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 organizational 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, while there is an extensive and theoretically developed literature examining the implementation of technology into healthcare more generally, there is a very limited range of published literature specifically on EHR in ambulance services.

Work Package 2 found that only half the UK ambulance services had EHR in use at the time of data collection. A further two were in the process of implementing new systems and had reverted to paper in the interim. Of those using EHR, three were changing the system they used and one was planning to do so. Implementing EHR was neither a single event nor a linear process, and entailed ongoing negotiation between frontline clinicians and managers. While 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 EHR 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 EHR 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 EHR system; and one service was using a digipen-based EHR system, while looking ahead to future adoption of a tablet-based system. Though we saw some indication of data being transferred into and out of EHR systems to support patient care, none of these seemed yet to be being used to their intended potential.

Positive aspects observed included vision and enthusiasm from senior managers; front line staff open to new systems; benefits in terms of data quality, confidentiality, and efficient storage and searching for audit and medico-legal 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 EHR creation at the time of the data sample ranged across sites from under a third of calls to over 99%. Factors associated with a lower rate of EHR completion included call received within routine working hours, call categorised as low priority, patient not conveyed, and mental health condition as 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 EHR system.

In Work Package 4, stakeholders attending the workshop felt 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 EHR devices; the need for information handover at the ED to be simple and streamlined; the role of a single point of ownership in the organisation; anxieties about data currency.

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

- Digital diversity: There is no standard hardware or software in use, with great variation in how (and whether) other technology and record systems were linked to the EHR.
- 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 EHR, but data entered by clinical staff is still sometimes written on a glove or notebook, or just remembered, before being entered into the EHR.
- Data dump: The primary function of EHR in all services seemed to be as a store for patient data. There was, as yet, limited evidence of their 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 EHR 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.

The experience of electronic records in ambulances has many similarities with the story of electronic records in healthcare 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 EHR systems requires a long chain of arrangements at a macro- (national policy), meso- (Trust adoptions) and micro- level (an electronic device retaining its charge) 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, some not.

Conclusions

Implications for healthcare

Living with change: Our findings suggest that the implementation of EHR in emergency ambulance services is not something which can be considered 'task and finish' but is a continuous work in progress. This requires a flexible and on-going approach to managing change.

Managing ambitions: Although EHR 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 EHR 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 EHR 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 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 EHR as a multi-functional resource: As well as being instruments of data storage, tablet based EHR have the potential to act as a portal to the world of information, both on the web 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 EHR devices get embedded in use and achieve maximum benefit.

Maximising use of EHR to support staff development: Feedback from EHR 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 ED, rather than the full EHR, 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 EHR, with managers typically more enthusiastic. There may be scope for more mutually beneficial communication to strengthen effective implementation of EHR.

Recommendations for future research

1. Ambulance services are collecting huge, potentially valuable resources in the form of routine datasets, 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.
2. There is scope for useful qualitative work on how ambulance service EHR are used (or not) in the ED and how they could be used better. We identified this opportunity, both from perspectives of ambulance clinicians (who often thought they weren't really being used) and from ED staff (who felt that the records were not particularly useful).
3. There is scope to examine patients' perspective on records and record keeping within emergency ambulance services to understand how these views and experiences may affect patient care.

4. EHR 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

Registered on the Health and Care Research Wales Clinical Research Portfolio (CRP) Study ID- 34166

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