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Systematic review

What to expect from electronic patient record system implementation: lessons learned from published evidence

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ABSTRACT

Background Numerous studies have examined factors related to success, failure and implications of electronic patient record (EPR) system implementations, but usually limited to specific aspects.

Objective To review the published peer-reviewed literature and present findings regarding factors important in relation to successful EPR implementations and likely impact on subsequent clinical activity.

Method Literature review.

Results Three hundred and twelve potential articles were identified on initial search, of which 117 were relevant and included in the review. Several factors were related to implementation success, such as good leadership and management, infrastructure support, staff training and focus on workflows and usability. In general, EPR implementation is associated with improvements in documentation and screening performance and reduced prescribing errors, whereas there are minimal available data in other areas such as effects on clinical patient outcomes. The peer-reviewed literature appears to under-represent a range of technical factors important for EPR implementations, such as data migration from existing systems and impact of organisational readiness.

Conclusion The findings presented here represent the synthesis of data from peer-reviewed literature in the field and should be of value to provide the evidence-base for organisations considering how best to implement an EPR system.

Keywords: electronic patient record, information technology, implementation lessons, benefits, barriers

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INTRODUCTION

Great Ormond Street Hospital (GOSH) and the associated University College London Institute of Child Health represent a large specialist, research active tertiary Children's Hospital in London. As a component of its digital strategy, GOSH underwent a procurement process for a comprehensive electronic patient record/electronic health record (EPR/EHR) system. In parallel to the core clinical EPR system procurement, a similar process was synchronously used to procure a research and analytics platform.

As a part of the process, previous peer-reviewed scientific publications regarding implementation of EPR systems were reviewed to determine which factors have been positively and negatively associated with successful implementations, and to derive data from which to base expectations for clinical activity during and following implementation.

METHODS

A literature search was performed of PubMed (all years to June 2017) using the search terms 'electronic [ti] AND record * [ti] AND (procurement [ti] OR implement * [ti])'. The search was restricted to articles published in English. This was not a formal systematic review but rather a review to provide a pragmatic, useful overview of previous findings in relation to EPR implementation in health care settings to inform practice.

RESULTS

Three hundred and twelve articles were identified in the initial search, of which 117 included findings relevant to purpose, presented below, categorised by area.

Overview

Early publications regarding EPR implementations provided simple descriptions without qualitative/quantitative data,[1] although critical appraisals of specific examples have provided 'lessons learned'.[2]

In general, implementing comprehensive EPR systems requires many strategic decisions around aspects such as programme scale, integration/replacement of existing systems, timing of implementation in clinical areas (phased versus 'big-bang'/enterprise-wide), the development of workflows/clinical pathways and order sets and planning regarding staff engagement. Most hospitals have departments in different stages of digitisation, some requiring integration, others paper based. Planning is also required to ensure supporting hospital infrastructures, such as wired/wireless networks, servers and cybersecurity, which are adequate for EPR requirements before implementation,[3] and principles of project management should be followed.[4]

Studies have identified several investment areas for EPR projects beyond technical infrastructure (hardware/software), including staff (communication, engagement and training), estates/facilities (space requirements) and operational issues (institution specific aspects and clinical workflow management). Such costs vary widely according to scope and size of organisational activities and baseline infrastructure, estates and staffing.[5]

In general, staff will have preconceived expectations for EPR systems regarding usability, support/training, communication, patient interaction and collaboration.[6] Main themes associated with EPR implementations also consistently include cost/resource, risk assessment, governance, customisation, clinical workflows, usability and training, and for most areas, there is a significant discordance between evidence and staff expectations.[7]

EPR implementations should drive clinical and operational changes, including improvement in clinical processes.[8] In one study, surgical clinic design, patient scheduling, physical space layout, staffing and workflows were all improved as a part of the 'EPR implementation' process.[9]

Chief Information Officers (CIOs) from English National Health Service trusts reported the expected benefits of EPR implementations to include efficiency, availability/accessibility of clinical information and patient safety; challenges were consistently around clinician engagement and inadequate resource (financial and human).[10] These are similar to USA CIOs, where physician cooperation was a major issue, in addition to maintenance and upgrades.[11]

Moving to an EPR system that represents significant organisational change is analogous to grieving, with staff experiencing loss, denial, anger, bargaining, depression and finally acceptance, many of which can be minimised by managing expectations through communication.[12] It should also be recognised that the EPR implementation should provide a sustainable platform for ongoing development rather than a single event. (*e.g.*, cross-platform/vendor mechanisms for bidirectional EPR data exchange and application development).[13]

There are limited data regarding EPR implementation effects on other specific services. One study examined help desk support, reporting increased call volume during go-live, which returned to baseline, with further increases during unplanned EPR downtime.[14]

Barriers to success

Several studies have identified barriers to successful EPR implementations (Table 1). Initially, difficulties were technical (integration, security and purchase cost),[15] but subsequently barriers were predominantly operational and behavioural, including physician engagement, workflow and cost of maintenance/upgrades. Indeed, several studies report major issues surrounding workflow changes when moving from paper-based systems.[8,11,16]

Organisational leadership and clarity of communication are vital, and staff must understand the significant changes in working practices associated with the EPR implementation. Unfamiliarity with new systems may be interpreted negatively and addressing such staff concerns can avoid subsequent difficulties.[17] End users may not feel engaged with the decision to implement or choose an EPR system[18] and usability issues (design, configuration and implementation) will increase clinical staff resistance, worsened if staff are not made aware that productivity may initially fall post-go-live. Workflow evaluation

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Table 1 Summary of main findings from studies reporting on barriers to successful EPR implementation

Study	Year	Barriers
Scantlebury *et al.*[28]	2017	Poor staff understanding of rationale and benefits Poor system integration Parallel paper systems Physician cooperation
Chan *et al.*[11]	2016	Costs of maintenance and upgrades Workflow changes
Harle *et al.*[27]	2016	Lack of recognition of clinical benefit
Chan *et al.*[11]	2016	Obtaining physician cooperation Costs of maintenance and upgrades
McAlearney *et al.*[12]	2015	Workflow and practice changes Shifts in expertise Patient interaction changes Training and education issues
Clarke *et al.*[10]	2015	Ensuring adequate clinician involvement limited financial and human resources
McAlearney *et al.*[12]	2013	Poor staff IT skills Resistance to workflow changes
Terry *et al.*[22]	2012	Poor staff training for system use Inadequate interoperability
Cresswell *et al.*[18]	2011	Poor user consultation Inadequate customisation
McAlearney *et al.*[16]	2010	Resources Ongoing system support User interface Regulatory compliance
Jensen *et al.*[25]	2009	Data reliability
Samoutis *et al.*[20]	2007	Staff ability to use technology
Wibe *et al.*[21]	2006	Staff training resource
Crosson *et al.*[17]	2005	Poor communication
Scott *et al.*[19]	2005	Poor usability
Retchin *et al.*[15]	1999	Lack of integration, security issues, providers who were inflexible and prohibitive purchase cost

itself may be traumatic, since staff roles or reporting structures may change. Leadership should address such issues early, consensus building in areas such as adoption, but with decisive leadership to resolve ongoing issues.[19,20]

General barriers include lack of sufficient resource for staff participation and training and the lack of senior staff involvement, such as chief nurses.[20–22] Behavioural barriers are consistently reported, especially persuading staff to change work practices,[23] with poor computer skills increasing resistance to change.[24] Usability should therefore be optimised[25] and issues regarding EPR supporting compliance with mandatory reporting should be addressed early.[16]

Despite these issues, in general, staff and patients are supportive of EPR systems.[20] Staff initially worry about changes in clinical practice, threats to professionalism, shifts in expertise, changes in patient interactions, impact on clinical training and effects on patient care,[26] without being aware of potential benefits.[27] There is generally poor staff understanding of rationale for EPR implementation, whereas their participation is related to the amount of training and support and understanding of benefits. Allowing parallel use of paper or legacy systems should be avoided.[28]

Factors associated with successful EPR implementation

Major success factors include strong organisational support with a visible executive team,[29] and well-communicated aims for clinical processes and workflows (Table 2).[8] Whilst

Table 2 Factors associated with successful EPR implementations

Study	Year	Success factors
Gross *et al.*[35]	2016	Identify and address gaps in system functionality early Consider aspects such as communication mechanisms, in addition to 'core' EPR functions Focus on usability
Joukes *et al.*[6]	2015	Alignment with work processes Support and training (ongoing) Use of patient data Improving general IT skills
Cucciniello *et al.*[34]	2015	Overt commitment across the whole organisation Development and resourcing of new roles
McAlearney *et al.*[24]	2013	Investment in mechanisms to assess ongoing impact Ongoing optimisation Investment initially in correct system selection
Craven *et al.*[44]	2013	Ensuring adequate hardware and technology Optimise workflows
Laramee *et al.*[39]	2011	Focus on staff training as customers
Corrao *et al.*[37]	2010	Early detection of usability issues
McAlearney *et al.*[43]	2010	Focus on continuous customisation and improvement Demonstrate data use for quality improvement
Fullerton *et al.*[36]	2006	Extensive staff involvement in system choice and implementation Investment in technical and training support at go-live
Badger *et al.*[38]	2005	Extensive training Champions from all disciplines
Souther *et al.*[29]	2001	Organisation support Executive visibility

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several generic factors facilitate success, such as project management, procurement and implementation strategies,[30] EPR-specific issues include early focus on system migration, ensuring adequate infrastructure, support and training and demonstration of efficiency.[31] Securing adequate information technology (IT) resources from the beginning of the programme is also essential.[32] Formal evaluation of organisational readiness for EPR implementation, in terms of culture, leadership, management, technical infrastructure, governance and operational planning improves the chances of success.[33] Recognition that EPR will require resourcing of new roles, in addition to investment in mechanisms to assess post-implementation impact are important.[34] Finally, there must be understanding of potential gaps in capability system functionality and awareness of important 'peripheral' effects, such as impacts on communication.[35]

Other success factors include obtaining representation from all user types, from procurement through implementation, to improve engagement, decisions, customization and workflow planning.[36] Early evaluation of usability issues allows customisation before go-live, improving user satisfaction.[37]

A consistent factor reported is technical support and training during implementation,[36] including hands-on training with staff (super users), such as doctors, nurses, administrators and IT staff.[38,39] This training should be 'role-specific', for example, nurses supporting nurses.[40] Furthermore, training will be required on an ongoing basis, for new staff, system upgrades and revisions.[6,32,41]

Infrastructure/network frustrations, poor user interfaces and unrealistic IT competence expectations are reported as factors requiring early attention, including a focus on IT literacy prior to EPR implementation.[42] Successful implementations emphasise ongoing optimisation and improvement, rather than just deployment, and demonstrate to users the system value.[24,43]

Investment of time during procurement for system selection and technology hardware requirements, along with optimising workflows are all associated with successful implementations,[44] with workflow optimisation in particular being a major ongoing component.[32,45] Whilst initial emphasis is ensuring safe EPR functionality, this should evolve towards user customisation and secondary use of data to improve outcomes, such as patient safety.[46] Successful sites demonstrate common themes, including the use of published evidence, focus on workflows rather than technology and ensuring that management structures facilitate the process.[47] Specifically, regarding academic medical centres, early and ongoing executive support, emphasis on training and support, ongoing system optimisation and patient portal functionality were success factors.[48]

Staff evaluation of EPR implementations

Distinct from the evaluation of organisational barriers and facilitators, several studies have examined staff views following the EPR implementation, providing information regarding satisfaction. In general, doctors report that patient care with EPR is better than previously, particularly regarding the quality of medical documentation.[49] There is of course marked variation across clinicians from 'disappointment' to 'tremendous', highlighting need for expectation management and staff preparation.[50] Overall physician acceptance of EPR is high, with 90% of junior medical staff preferring EPR over paper records; junior staff generally show greater approval ratings than consultants, likely representing age-effect in relation to acceptance of change and uptake of technology.[51]

Medical staff may have reservations about potential negative effects on the quality of care and patient interactions and also concerns regarding their own competency in EPR use, although most of these no longer exist once benefits are recognised.[52] Most physicians do, however, feel that EPR use requires more of their time, albeit associated with improved documentation, but suggesting that this results in reduced teaching time for juniors.[53,54]

Overall, doctors' satisfaction with systems is associated with the adequacy of training and support and system usefulness for their specific practice.[55] In general, staff who were described as innovative were much less likely to view EPR implementation as difficult.[56]

Clinicians often initially feel that EPR is time-consuming, particularly if inadequate hands-on training/support is provided.[57] Despite this, most agree that EPR use improves billing and quality, with those using comprehensive systems more likely to report positive effects.[58] Doctors generally adapt to the workflow changes required and recognise benefits such as decreased time out of the examination room.[59] For example, whilst there were initial concerns about impact on patient interaction by opthalmologists, there was no actual effect on clinic efficiency or satisfaction.[60]

Broadly, older clinicians tend to have worse opinions of EPR,[61] and a trend for older medical staff to leave or retire around EPR implementation is reported.[62] However, most clinicians refuse to return to handwritten records.[63] The apparent increased clinician time required to operate EPRs should be addressed early.[64]

Several studies have evaluated nursing views and report that nurses are largely positive, EPR being associated with improved documentation, increased satisfaction, drug information accuracy and patient safety.[65,66] The main challenges are around the documentation processes and difficulties in interdisciplinary communication[67]; face-to-face communication between nurses and doctors may be significantly reduced post-EPR implementation.[68] It is therefore important that senior nurses are involved early to reduce these effects and encourage uptake.[69]

Few studies have examined effects directly on patients, but in general, EPR implementation does not affect patient satisfaction,[70] with no improvements in waiting time.[71] However, the use of patient portals is associated with patients feeling more prepared for their appointments,[72] and the availability of health information was considered valuable.[73]

Productivity effects

Numerous studies have evaluated the effects of EPR systems on efficiency/productivity (Table 3). Short-term

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Table 3 Studies reporting on efficiency and productivity pre- and post-EPR implementation

Study	Year	Main findings
Yadav *et al.*[77]	2017	More documentation errors overall Improved physical finding documentation
Akenroye *et al.*[117]	2017	No effect on hypertension or obesity rates
Haidar *et al.*[88]	2017	Reduced physician productivity in outpatients
Riahi *et al.*[100]	2017	Overall significant cost savings due to reduced medication errors, better implementation of clinical practice guidelines, improved infection prevention and cost-effective diagnostic testing.
McDowell *et al.*[89]	2017	Operating theatres increase in patient turnaround time of around 20% post-implementation, which returned to baseline by 6 months
Caryon *et al.*[107]	2017	Reduced ITU medication errors
Rupp *et al.*[86]	2017	Emergency department, sustained increase in length of patient stay until around 1 year later.
Dean *et al.*[96]	2016	Improved quality of discharge summaries
Han *et al.*[93]	2016	Reduced severe medication errors and ICU mortality
Finn *et al.*[106]	2016	Improved detection of prescribing errors
Raval *et al.*[105]	2015	Reduced clerical errors, work hours saved annually by EPR-based handovers.
Wormer *et al.*[76]	2015	Significant increase (approximate doubling) in average time spent by junior staff documenting in the first 6 months post-EPR implementation, which improves over time but remains greater than baseline
Singh *et al.*[87]	2015	No effect on efficiency
Flatow *et al.*[92]	2015	Reduced ICU mortality
Ward *et al.*[82]	2014	Transient increased length of stay until 8 weeks Increased laboratory testing and imaging
Ward *et al.*[83]	2014	No effect on emergency room length of stay
Reddy *et al.*[84]	2014	No effect on outpatient volume
Patterson *et al.*[85]	2014	No effect on readmission rates (cardiac)
Hye *et al.*[116]	2014	Increase in aortic aneurysm screening rates
Gascon *et al.*[104]	2013	Laboratory medicine, reduced errors, improved turnaround times, integration into record
McGuire *et al.*[113]	2013	Improved ability to provide care more safely.
Wang *et al.*[114]	2013	Increased appropriate antithrombotic therapy, blood pressure control, HbA1c testing and smoking cessation intervention.
Reed *et al.*[115]	2013	Reduced emergency visits in patients with diabetes mellitus
Gascon *et al.*[104]	2013	Improved laboratory processes (better patient identification, less labelling or requesting errors and shorter response times)
Kritz *et al.*[108]	2012	Improved annual assessment performance
Spellman *et al.*[81]	2012	Transient increased emergency department length of stay and time to see doctor, resolved by 3 months
Herrin *et al.*[112]	2012	Patients with diabetes more likely to receive optimal care
Cook *et al.*[103]	2011	Increased antimicrobial recommendations Reduced antibiomtic use Reduced nosocomial infections.
Albuquerque *et al.*[95]	2011	Reduced physician calls to treatment units
Harshberger *et al.*[109]	2011	Improved quality of data collection
Gunnigberg *et al.*[110,111]	2008, 2009	Post-EPR improvement in recording of pressure ulcers.
Verwey *et al.*[79]	2008	No time efficiency savings
Grieger *et al.*[97]	2007	Improved billing accuracy and cost recovery
Rosenbloom *et al.*[94]	2006	Improved documentation of weight and height (growth charts)
Evans *et al.*[98]	2006	5% productivity increases per annum
Pizziferri *et al.*[78]	2005	No difference in overall time per patient in clinic
Keshavgee *et al.*[75]	2001	Increased clinician time required for documentation Returns to baseline by 18 months post-go-live

implementation impact must be distinguished from long-term effects, although most studies have focused on the immediate post-implementation period.

EPR implementation is associated with the increased clinician time entering data.[74] In one study, staff time spent 'documenting' increased initially by 50%, returning to baseline by

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18 months; (partly due to drop-out of physicians who found EPR difficult).[75] Another study reported approximate doubling of average time spent by junior staff documenting in the 6-months post-EPR implementation, which improved but remained greater than baseline.[76] In a pre-/post-study of EPR, rates of inaccurate documentation were significantly higher compared to paper charts, but expected physical examination findings were more frequently recorded. However, inaccuracy rates were significantly lower for junior staff compared to consultants, suggesting 'user' rather than 'system' factors.[77]

In a study evaluating outpatients, post-implementation, overall time per patient was not significantly different, although users felt that documentation took longer.[78] Another study also reported no time efficiency post-EPR,[79] whilst another study reported average total time per patient as significantly longer.[80] Clinical impact, however, depends on the setting. In the study of emergency department activity, the overall length of stay and time to see a doctor increased during EHR implementation by 5%–20% but returned to baseline within 3 months.[81] Another emergency department study reported that average length of stay increased and patient satisfaction reduced transiently, returning to baseline by 8 weeks. However, laboratory testing, medication administration and radiologic imaging all showed sustained increase-post-implementation.[82] In a further study, no difference was found in measures of operational performance,[83] and others also report no effect on outpatient volumes[84] or readmission rates.[85] The most recent emergency department study reported no differences in volume, admissions, or transfers but increased length of stay until 1 year later.[86]

In a pre-/post-implementation study in a specialist eye hospital, there was no significant change in patient volume or diagnostic tests usage,[87] whereas a similar study in an emergency department reported increased patient processing time, which improved to better than baseline over 10 months. In an outpatient study, physician productivity initially decreased by 20%, but with the corresponding reduced time spent post-clinic reviewing documentation.[88] In operating theatres, EPR implementation was associated with significant increases in patient turnaround time of around 20%, which returned to baseline by 6 months.[89] Implementation of EPR should generally be expected to be associated with an initial decrease in efficiency during the first 6–12 months[90] and strategies should be developed to minimise this.[91]

Few studies report direct effects on patient outcome, most focusing on billing and efficiency, but in one intensive care unit (ICU) study, whilst there was no significant difference in length of stay or readmission rates, there was significant reduction in central-line infection and overall mortality rates.[92] Similarly, another ICU study reported significantly decreased overall mortality, due to reduced medication errors.[93]

EPR use is associated with improved documentation[94] with indirect benefits for medical staff; in one study, doctors were called to the treatment unit less since therapists had clearer understanding of treatment plans.[95] EPR use may also be associated with benefits to healthcare staff beyond the institution, including improvement in the quality and speed of discharge summaries.[96]

Since EPRs are associated with improved billing accuracy, initial costs may be offset long term. In one study, costs were recaptured within 16 months, with ongoing annual savings and no adverse effect on efficiency.[97] In another, overall productivity increased by around 5% per year post-full EPR implementation[98]; whilst productivity may initially fall, billing income may increase due to improved coding.[99] Furthermore, cost-savings include reduced medication errors, improved implementation of clinical practice guidelines, enhanced infection prevention and cost-effective diagnostic testing[100]; order-set creation and care pathway redesign have significant benefits.[101] Such guideline integration may require calculated and complex variables, hence workflows may require modification to collect such data.[102] In one study, care pathway EPR integration was associated with reduced nosocomial infections.[103]

EPR use is associated with improved laboratory safety and patient identification, less labelling and requesting errors and shorter response times.[104] EPR-based handover between staff is associated with reduced clerical errors, greater satisfaction and improved efficiency, accuracy and safety; (around 400 work hours saved annually in one service).[105] There is an improved identification of significant prescribing errors, which improves patient safety,[106] and in an ITU study, the medication error rate significantly decreased post-implementation, including ordering, dispensing and administration.[107]

A well-documented benefit is improved population-based screening, due to the ability to identify patient cohorts, alert clinicians and suggest protocols. For example, improvement in performance of annual medical and multidisciplinary assessments[108] and data quality,[109] recording of pressure sores,[110,111] and proportion of patients receiving 'optimal care'.[112,113] EPR use is associated with significantly improved rates of appropriate antithrombotic therapy, blood pressure control, HbA1c testing and smoking cessation intervention,[114] whilst in patients with diabetes, EPR use results in significantly less emergency visits, overall doctor visits and hospitalisations.[115] Abdominal aortic aneurysm screening rates improved where EPR alerts are used with significantly reduction in unscreened patients from 50% to 20%.[116] However, despite improved screening, there is little evidence for improvements in rates of raised blood pressure or obesity.[117]

DISCUSSION

Existing literature describes factors influencing implementation success, such as leadership and management, infrastructure and staff training, and focuses on workflows and usability. In general, EPR implementation leads to improvements in documentation, screening performance and prescribing, whereas the minimal data are available in areas such as patient outcome. The findings presented will be of value to organisations considering how best to implement EPR systems.

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However, several caveats should be applied when interpreting literature in this area. First, organisations have different starting points, in terms of clinical activity, processes, culture, infrastructure and extent of digitisation, prior to EPR implementation, all of which significantly affect the method of implementation and likely success. Second, studies presented are predominantly performed in isolation, addressing one specific area without accounting for effects on the overall organisation, for example, service management; 24/7 IT support will be required which may not have been the case with paper-based systems, with associated resource implications. A consistent message from centres that have embarked upon comprehensive implementations is that an 'inch-deep mile-wide' approach is favourable since niche customisation slows, and adds significant cost and risk, with an optimisation phase once the system is in use.

The management of staff expectations is consistently recognised as important. Since an EPR programme represents major organisational investment and change, staff and executives may have unrealistic expectations that all organisational problems will be solved when, in reality, new issues may be created. For example, workflow evaluation for EPR provides data that may have been previously unavailable, producing a more transparent view regarding the state of clinical services and processes that were previously not appreciated. Apparently new 'problems' appear and areas of non-compliance become highlighted. Similarly, since EPR allows formal control of organisational policies, such as role-based access and permissions, there may be resistance to the 'system' rather than underlying policies. Process planning requires the evaluation of current processes, which may uncover suboptimal practices; attempts to engineer a 'perfect' EPR process into an underlying system that requires change should be avoided. The EPR go-live should be regarded as a starting point for system and workflow optimisation, which also required appropriate resources.

Staff training and engagement are consistently highlighted to influence implementation success. However, the practicalities of achieving an appropriate training plan across all staff groups remains complex. Requirements for training must balance the need for training *versus* maintaining the operational performance, with associated cost. For example, staff may work shifts, including night work, and training must ensure that all such staff are skilled without reducing clinical care. Focusing training to support clinical roles is also beneficial, with clinical context-based peer-led teaching having anecdotal reports of value.

IT literacy of staff may vary greatly, with some having poor computer skills, particularly those who selectively choose roles such as night shifts. Others, such as administrative staff, may be highly familiar with existing 'bespoke' systems, and have developed numerous workarounds/shortcuts to perform tasks quickly. For such people, the move to 'user-friendly' EPR systems may reduce their efficiency. Furthermore, since such administrative/secretarial staff have impact on clinical activities, awareness of the needs of their needs should be regarded of equal importance to 'front-line' staff. Indeed, there are anecdotal cases of administrative staff complaints leading to clinicians refusing to use systems.

The literature appears to under-represent technical factors, such as data migration and conversion from existing systems. The extent and complexity of these tasks depend on the organisational starting point, but awareness of current data systems and how data will integrate to EPR are of major importance for usability. For example, migrated data may behave differently to 'native' EPR data, there may be subtle nuances in field mapping/data translation which can lead to operational and/or safety issues. Furthermore, this process results in the examination of data quality and previously unknown issues may become apparent.

In conclusion, although implementation of an EPR system represents a highly complex change programme impacting the entire organisation, utilising findings from previous experience and research can provide a basis for future evidence-based decisions. Many factors relating in particular to programme leadership, IT infrastructure, adequate real-world staff training and workflow optimisation are reported in relation to implementation success. Whilst EPR systems result in improved clinical documentation, medication prescribing and population screening, demonstration of positive effects on clinical patient outcomes requires further research in many areas.

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