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Why you should read this article

- To understand the research potential of electronic health records (EHRs) as an existing data set of nursing interventions
- To critically examine some of the limitations of collecting administrative data from EHR systems in research
- To explore these issues through a study of the role of the school nurse in safeguarding children

Exploring the challenges of using electronic health record systems in nursing research

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Abstract

Background Electronic health records (EHRs) provide an interesting potential data set for nursing research. However, they can present challenges when collecting data, as EHR systems are not designed with research in mind.

Aim To present an example of collecting data using EHRs that was conducted as part of a study of the role of the school nurse in safeguarding children.

Discussion Data were successfully obtained from EHR systems to understand school nursing caseloads and interventions with vulnerable children and young people. Major limitations included variances in EHR systems, such as different nomenclature for interventions. These limitations were addressed by reviewing organisational guidance on record-keeping and through a working knowledge of the different EHR systems.

Conclusion Conducting research using EHRs has provided important learning about the potential of this type of data and the promise they hold for future research.

Implications for practice Organisations willing for existing data to be used in research might consider embedding pathways for collecting data that are easy for potential researchers to navigate. EHR systems need to be sensitive to research, but not at the expense of efficiency in clinical practice.

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Introduction

Electronic health record (EHR) systems are designed to electronically store and organise data concerning patient care. Records can include diagnoses, patient notes, nursing care plans, test results and clinician diaries (Häyrinen et al 2008). Several systems are used globally, and the NHS in the UK hopes to move towards paperless patient records by 2020 (National Information Board 2014).

Using results from EHRs in research is defined as secondary analysis of existing data, which encompasses data collected for other purposes – such as registries of births and deaths – and data originally collected

for other studies (Cheng and Phillips 2014). It typically involves analysing electronic patient notes or running system reports on administrative data using preset templates (Castillo et al 2015, Connelly et al 2016).

Researchers have become more interested in recent years in using EHRs in their research, driven in part by the increasing implementation of EHR internationally and general improvements in computing technology (Bates et al 2014, Jin et al 2015). Health research that uses large existing data sets – sometimes referred to as 'big data research' – could support answering research questions at a population level (Bates et al 2014, Zhang et al 2018). Researchers can use EHRs to obtain broad health information for a large population (Cowie et al 2017, Zhang et al 2018), without having to rely on participants' responses to other methods of primary data collection (Castillo et al 2015, Connelly et al 2016). Collecting data from EHR systems can also be more cost-effective than using primary methods of collecting data and reduces the burden on potential participants (Zhang et al 2018).

Data are subject to audits (Nursing and Midwifery Council 2018) that compare current practice against a specified organisational standard – such as contemporaneous record-keeping – and are not for the purposes of testing or answering a research question (Regulation and Quality Improvement Authority 2018). Data can therefore be presumed to be unbiased in relation to any future research, as it is collected only for clinical purposes (Appleton and Cowley 1997). However, there are challenges when using EHRs in research. The use of clinical records by health providers and researchers for evidence of care provision may be in conflict with the perspective of some nurses, who find the amount of record-keeping activities increasingly overwhelming and distracting from direct time with patients (Cunningham et al 2012). Patients are informed their confidential health data may be used in research or service improvement in the UK; NHS patients in England have been able to 'opt out' of this since 2018 (NHS England 2018) and all health and care organisations in England must introduce similar opt-out processes by 2020 (NHS England 2019).

This paper presents an example of using EHRs in a research study that examined the role of the school nurse in safeguarding children. It provides an overview of the advantages and disadvantages of using EHRs in research, a description of data collection, limitations, and recommendations for future practice.

The study

A PhD study of the role of the school nurse in safeguarding children was conducted with three school nursing services from three different health organisations in England – two NHS trusts and one private provider – with data collected between June 2016 and January 2018.

Design

The study's design involved two stages: analysis of the data from EHRs – school nurses' electronic diaries and caseloads – and semi-structured interviews with 25 school nurses. Electronic diaries were a routine part of clinical practice for the nurses, who used them to record the times of appointments, the interventions offered and appointments' outcomes. The diaries are evidence of nursing care and can be used as legal documents (Stevens and Pickering 2010). Data were collated from the diaries to understand the nurses' caseloads and the type and frequency of appointments they offered vulnerable children and young people.

Data collection

One of the study's objectives was to understand the type and scope of interventions offered to vulnerable children and young people by school nurses. A data request sheet was therefore developed according to the research team's knowledge of EHRs and the information that might

Key points

- Data from electronic health records (EHRs) have the potential to explore research problems in the everyday clinical context
- EHR systems in England are largely fragmented and pathways to collecting data for researchers are not always clear
- Building relationships with important stakeholders and a good working knowledge of EHR systems can support the researcher in using this method of collecting data

best address the study's objectives. The sheet contained a list of items of information to be obtained by a designated member of the information technology or service performance team running reports on school nursing activity recorded in EHRs (Table 1). The items on the sheet were informed by the study's aims and objectives and a systematic review of school nursing literature (Harding et al 2019).

The sheet was then securely emailed to a contact in the service management team of each organisation for feedback and initial advice. This contact was identified through discussion with the school nursing managers in each organisation. In addition, one member of the research team was a practising school nurse with a working knowledge of EHR systems, so could discuss the possible limitations and availability of data when developing the data request sheet.

Data were requested for the previous two academic years, 2015/2016 and 2016/2017, as the school nursing services mostly worked only during the academic year. However, most data could only be provided for 2016/2017 because those collating the information had insufficient time to obtain it or only had permission to view information for the latest reporting year; in one case, a school nursing service had changed to be run by a private health provider and the new provider could not access any data owned by the previous provider. These are not direct issues with EHR systems themselves, but are part of the wider complexities of conducting research with a large, dynamic health organisation.

Ethics and confidentiality

Ethical approval for the study was obtained from the university affiliated to the study and the Health Research Authority. The EHRs in this study were 'owned' by the NHS, rather than the schools at which the nurses worked, and the schools had no access to them. Therefore, each of the three data sets represented school nursing activity in one school nursing service and the schools this service encompassed. Schools and school nursing services had different policies concerning sharing information and confidentiality, so

Table 1. The data request sheet

Research question (derived from a systematic review)	Data request
How many children are there on the school nursing caseloads?	1. What is the total school nursing caseload size? 2. What is the total child protection* caseload size? 3. What is the total child-in-need† caseload size? 4. What is the total team around the child or team around the family‡ caseload size?
How do school nurses identify children at risk of child abuse?	5. What is the total number of referrals made to social care by school nurses in the last academic year? 6. What is the range of risk assessment tools used by school nurses to safeguard children and young people?
What interventions are offered to children at risk of child abuse?	7. What is the total number of contacts/interventions with all children by the school nursing team in the last academic year? 8. What is the total number of contacts/interventions with children with a safeguarding or child protection alert (on their clinical records) by the school nursing team in the last academic year? 9. What is the average total time spent on interventions relating to all children by the school nursing team in the last academic year? 10. What is the average total time spent on interventions relating to children with a safeguarding or child protection alert (on their clinical records) by the school nursing team in the last academic year?
How do school nurses work with children at risk of child abuse?	11. What is the range and type of interventions provided by school nurses relating to all children in the last academic year? 12. What is the range and type of interventions provided by school nurses relating to children with a safeguarding or child protection alert in the last academic year?

*child on a local authority child protection plan due to risk of significant harm †child on a local authority child-in-need plan due to concerns regarding wellbeing ‡child on a voluntary team around the child or family plan involving multi-professionals due to a specified need

maintained different and separate record-keeping systems. Schools did not keep records about school nursing interventions, so this did not affect the method.

The contact identified in each health organisation was offered a telephone call or face-to-face visit, to talk through the data request sheet and any issues or concerns. This was to promote trust and good communication, which can be central to positive collaboration between and within agencies (Williams 2011). Each study site accepted this offer.

After the data were collected, to maintain patient confidentiality, the contact removed all names and any other identifiable information of school nursing staff and patients, before sending the research team the completed data request sheet or the final data set as Microsoft Excel spreadsheets according to the contact's preference using secure, encrypted email. The data were then stored on the university's Google Drive cloud storage and encrypted with a password.

Data management

Each organisation returned two or three spreadsheets or the data request sheet; one spreadsheet included a 'pivot table' – an interactive table that generates data from the spreadsheet. It was therefore necessary to extract the required information and aggregate it into a more manageable format.

The lead author used Microsoft Excel to do this, aggregating data for each school nursing service concerning the overall activity of the school nursing service, rather than individual nurses. The data for each organisation were then transferred onto a master spreadsheet, to aid comparison between services. The master spreadsheet contained tabs for each school nursing service and a tab to present comparable data for the services.

Discussion

This study provided an insight into annual school nursing activity at multiple sites. It allowed the research team to begin to understand and compare the size of school nurses' caseloads and the frequency and type of interventions offered to vulnerable children and young people. Using EHRs meant school nurses did not have to provide additional information to inform the research. However, obtaining the data from each school nursing service was a lengthy process of approximately 10 months that involved negotiating with multiple parties in the organisations and a third party collecting and anonymising the data to be sent to the research team.

It was essential in the study to have the cooperation of a designated professional in each organisation to collect and anonymise the data from the different systems. The lead author invested effort in maintaining communication, providing support and offering gratitude to these professionals, which proved valuable in ensuring their continued cooperation.

Working at the boundaries between different kinds of organisations, such as health providers and universities, can be challenging; it is important to communicate well, build trust and set out a common vision for the outcome of the project (Williams 2011). Investment in regular support and liaison with major stakeholders throughout the study can improve engagement, as it makes them feel included in decision-making (Phillipson et al 2012).

Obtaining data from EHRs had several anticipated limitations and despite attempting to control for these, some of the results highlighted the complications of using systems not designed for research. There were several possible recording discrepancies, such as one recording of a 'new birth visit', despite school nurses working solely with children and young people aged five to 19 years old. Recording discrepancies are unavoidable in large sets of administrative data because of everyday 'human error' (Sivarajah et al 2017, Zhang et al 2018). Clinicians may misclassify interventions when selecting from preset options and distractions

in the clinical environment may affect the time and concentration required for record-keeping (Brouwer et al 2015, Castillo et al 2015).

These limitations exist because most EHR systems are not designed with research in mind – they are primarily for supporting clinical care and providing commissioners with evidence about the performance of a service against financial targets (Brouwer et al 2015, Cowie et al 2017). EHR systems are usually designed and supported by a sub-contractor, which bids to provide such services to a health provider through a tendering process. EHR systems are typically efficient, timely and cost-effective (Ozair et al 2015), but tendering means systems used across the UK and other countries by local health services are often different and the information held in varied systems about a patient can be fragmented.

Comparing data across different services and organisations can be challenging, if they use different EHR systems and different labels for interventions (Castillo et al 2015, Connelly et al 2016). In this study, there were differences between services in the size and definition of the term 'school nurse caseload'. The EHRs included many nondescript labels to define interventions – for example, 'school nurse clinic appointment' – that sometimes made it unclear what nursing care had been provided. Obtaining the record-keeping guide for each service from its lead for school nursing helped to understand how school nurses might categorise their interventions and to compare similar interventions across the different services.

It was also complex to attempt to combine data from three different EHR systems with differing formats and labels. Not all organisations could provide the full data set in response to the original data request, as the EHR systems did not have the required sensitivities – either the system did not record data with the accuracy needed to answer some questions or it was impossible to run a report to collate the information required. One organisation also felt it was too time-consuming to investigate how to alter the system to run such a report.

A reflection on the study deemed it to be an important learning activity, especially as there is increasing interest in this type of research.

Conclusion

Data from EHRs that was expected to be recorded contemporaneously and in real-time provided an overview of school nursing practice across a large area. Challenges of using EHRs included having to liaise with multiple stakeholders and the lack of sensitivity of EHR systems to answer detailed research questions. Improved liaison between research institutions and health organisations internationally could improve pathways for researchers to access health data and improve EHR systems.

Recommendations for practice

Consistent and comparable EHR systems are important, if school nursing services and other health and social care organisations are to be examined and compared nationally and want to be used as evidence of the effect of school nursing care. Organisations that want to engage in EHR research might consider pathways that are easy for researchers to navigate to obtain data, and consider using systems that are amenable to research as well as service audits and key performance indicators – although systems must remain efficient for practice, as nurses can find the amount of record-keeping needed increasingly overwhelming and distracting from direct time with patients (Cunningham et al 2012, Royal College of Nursing 2018). Organisations that do not already involve front-line practitioners and staff with research expertise in the design and implementation of record-keeping systems might consider doing so as a way of promoting systems fit for the future of health research.

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