Research article

Barriers and facilitators to health information exchange in low- and middle-income country settings: a systematic review protocol

Author address for correspondence:
Ather Akhlaq
eHealth Research Group
Centre for Population Health Sciences
Medical School, Teviot Place
Edinburgh, EH8 9AG, UK
Email: ather.akhlaq@ed.ac.uk

Ather Akhlaq
eHealth Research Group, Centre for Population Health Sciences, The University of Edinburgh, Medical School, Edinburgh, UK

Aziz Sheikh
eHealth Research Group, Centre for Population Health Sciences, The University of Edinburgh, Medical School, Edinburgh, UK

Claudia Pagliari
eHealth Research Group, Centre for Population Health Sciences, The University of Edinburgh, Medical School, Edinburgh, UK

ABSTRACT

Introduction The ability to capture, exchange and use accurate information about patients and services is vital for building strong health systems, providing comprehensive and integrated patient care, managing public health risks and informing policies for public health and health financing. However, the organisational and technological systems necessary to achieve effective health information exchange are lacking in many low- and middle-income countries (LMIC). Developing strategies for addressing this depends on understanding the barriers and facilitators to health information exchange (HIE) at the individual, provider organisational, community, district, provincial and national levels. This systematic review aims to identify, critically appraise and synthesise the existing published evidence addressing these factors.

Objective To assess what is known, from published/unpublished empirical studies, about barriers and facilitators to HIE in LMIC so as to identify issues that need to be addressed and approaches that can fruitfully be pursued in future improvement strategies.

Methods We will conduct a systematic review to identify the empirical evidence base on the barriers and facilitators to HIE in LMIC. Two reviewers will independently search 11 major international and national databases for published, unpublished and in-progress qualitative, quantitative and mixed methods studies published during 1990–July 2014 in any language. These searches of scientific databases will be supplemented by the eligible reports available online. The included studies will be independently critically appraised using the Mixed Method Appraisal Tool, version 2011. A descriptive, narrative and interpretative synthesis of data will be undertaken.

Results These will be presented in an article that will be published in the peer-reviewed literature. The protocol is registered with the International Prospective Register for Systematic Reviews (PROSPERO) CRD 42014009826.

INTRODUCTION

Health information has been defined as the 'foundation' for better health, the 'glue' for sticking and holding health systems together and the 'oil' lubricating these systems to keep them running.[1] Health information is the information about people's health that describes the occurrence, prevalence and causes of major illnesses, diseases and infections along with the availability, use and effectiveness of remedial actions.[2] The availability of standardised reliable health information is indispensable for observing, measuring and monitoring the coverage, quality and outcomes of health services. Likewise, the timely capture and analysis of data obtained through surveillance of health threats and epidemics informs strategies for their prevention and containment.[3] Providing the infrastructures and technologies that can enable data to be accurately collected, exchanged and analysed in a timely manner can thus aid in the management of individual patients and strengthen the governance and effectiveness of health systems and improve population health.[4]

The World Health Organization (WHO)'s Framework for Action has identified health information as one of the six essential building blocks of effective health systems.[5] The other five are health workforce, leadership and governance, service delivery, financing, and medical products, vaccines and technologies. According to Health Information for All 2015 (HIFA 2015), the availability and use of appropriate and reliable health information is essential to the achievement of Millennium Development Goals (MDGs). HIFA was founded in 2006 with the aim of ensuring that every person in the world will have access to an informed health care provider (see www.hifa2015.org). Furthermore, the United Nations' (UN's) High Level Panel on the post-2015 Development Agenda recently called for a 'data revolution' for sustainable development, with a new global initiative, Global Partnership on Development Data, to improve the quality of information and statistics available to diverse interested stakeholders – people, government, international organisations, foundations and the private sector.[6]

These goals will only be achieved when interested stakeholders are prepared and able to participate in health information exchange (HIE) across health providers, organisations and systems. Such stakeholders include doctors, nurses, health workers, pharmacists, managers and patients in order to support the delivery of optimum quality of health care at the community, district and national levels. For example, information is required at individual and community levels to meet the needs of the local population; at the district level, to help health managers and planners to make judgements and decisions regarding the health system and the effectiveness of health facilities; and at the national level, to make strategic decisions about resource allocation.[7] Moreover, co-operation is required among a wide variety of specialists including health care providers, researchers and policy makers for the development of robust systems that can provide reliable, relevant and usable information to support delivery of effective health care services.[8]

Sound information is also indispensable for monitoring public health outcomes and actions such as planning, programming, policy making and monitoring. Similarly, it is required to ensure accountability of resources and to evaluate the progress of nations against global objectives such as the MDG, which can be improved through strengthening information management at all levels of countries' health systems.[9,10] Better data and statistics can enable governments to track progress in a timely fashion.[6] Accurate health information can empower stakeholders to identify the neediest, for example malaria or human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) patients, and determine whether they are receiving required essential services and facilities. The absence of relevant and reliable health information is a major contributor to preventable deaths and sufferings.[11]

According to the World Bank (WB), a developing country is one in which the majority of the inhabitants live on low wages, with far fewer public services available to them than those available in the highly industrialised nations.[12] Gross national income (GNI) is the main criterion used by the WB to classify economies into low- and middle-income countries (LMIC), which sometimes are also known as developing economies.[13] These developing economies are divided into different groups, with respect to GNI per capita, for example (1) low income: $1035 or less; (2) lower middle income: $1036–$4085; and (3) upper middle income: $4086–$12,615. Developed or high-income countries, on the other hand, have a per capita income of $12616 or more.

Lack of access to health information makes it unlikely that LMIC will be able to realise the goals of truly 'informed health care' in the near future, as has been envisaged for higher income regions.[14] Because many LMIC are unable to generate reliable, complete and timely information about patient health, disease, care and outcomes, their progress in meeting key heath indicators such as the MDG cannot be easily established. Such data are often incomplete and there are frequent significant time lags between data collection periods.[15] For example, over 40 LMIC are incapable of tracking progress on extreme poverty and hunger due to insufficient data.[16] Many national authorities are not able to report reliable health-related information to international organisations and donors such as UN and WHO due to poor information capture and management.

Studies on health information systems (HISs) in LMIC have identified a range of barriers to various types of health information exchanged and shared between suppliers/producers, consumers and users.[2,17–20] Fragile HISs are increasing dissatisfaction and frustration among producers and users of health data. The introduction of technology and the provision of finance for strengthening weak health systems do not address all of these problems, as there are other technical, structural and sociotechnical barriers that also need to be considered.[21–23] For example, HIE at the provincial or national level can only be useful if connectivity and exchange of health information exist at the individual, community or district levels in the first instance.

Given these challenges, there is a pressing need to better comprehend the barriers and facilitators to HIE at individual, provider, community, district, provincial and national levels, especially in LMIC. An appreciation of the barriers and facilitators to accessing, sharing and exchanging health information in different LMIC will allow stakeholders to better understand possible solutions to tackling the problem currently experienced with HIE.

Systematic reviews can be useful for informing the development of evidence-based strategies to address the problems faced by LMIC.[24] This systematic review seeks to capture, appraise and synthesise the existing empirical evidence documenting challenges and facilitators to HIE in LMIC. It has the potential to inform guidelines for international donor agencies, national authorities and global health organisations, such as the WHO, the UN and the WB, wishing to develop effective strategies for investment in the design and implementation of HIE.

Past similar reviews/systematic reviews/studies: identifying gaps

Related similar systematic and academic reviews had been conducted, but these have major limitations.

Williams and Boren (1) studied the benefits of electronic medical records (EMR) with respect to patients, physicians and other care providers and their contribution to the development of health care delivery in developing countries. This involved searches of only four academic databases (i.e. Medline, CINAHL, COMPENDEX, Academic Search Premier), which contributed to the sub-optimal search strategy. Articles not published in English language were excluded. Another important limitation was that no quality assessment tool was used to appraise the methodologies of the included studies. The first eligible study found was from the year 1995. The study found that most of the developing countries lack the experts, funds, infrastructure and sustainable energy necessary to implement the health care technology. In contrast, support from developed countries in designing and implementing the computer-based health records in developing regions and availability of open-source software were found as facilitators.

Another systematic review by Ndabarora[26] focused primarily on problems with health data quality and health information management, and evidences of best practices and use at community and district levels in LMIC to improve these. It involved searches of five academic databases (i.e. Pubmed, Medline, LISTA, CINAHL, Cochrane) and a Google search engine to search for citations, conference proceedings and disease surveillance reports from 2000 to 2011. The quality of the included studies was assessed in terms of study outcomes, but it was unclear which, if any, quality assessment tool was used. Only English language articles were included in the review. Poor quality health data, poor management of HIS and low usage of health information were found to be the main problems of health data quality management.

A comparative study by Mutale[27] focused on improving HIS for decision making in five sub-Saharan African countries,

namely Ghana, Mozambique, Rwanda, Tanzania and Zambia, connected with one another through the Population Health Implementation and Training (PHIT) Partnerships to enhance district health systems. The study described, compared and contrasted the PHIT approaches from these five countries to strengthen HIS and encourage the use of data in decision making, focusing on the implementation strategies from the African Health Initiative.

In general, an academic review on health systems in LMIC[28] revealed that the strengthening of the health systems in LMIC is a long-term evolutionary process. There is no single blueprint for a perfect health care system,[28] as health care systems are complex social systems.[29] A stronger evidence base that contributes to cross-country learning is required to strengthen the health care systems in LMIC.[28]

While some of the above reviews have considered issues relevant to electronic HIE, none was specifically focused on barriers and facilitators to HIE. Keeping in view the research gaps, limitations and future directions mentioned in the previous reviews, a new systematic review is required on a broader scale, which encompasses all the relevant domains of barriers and facilitators to HIE in LMIC.

Research question

What are the barriers and facilitators to the implementation and adoption of electronic HIE in LMIC?

METHODS

Registration

The systematic review is registered with the PROSPERO International Prospective Register of Systematic Reviews with the registration number CRD42014009826. It can be accessed at the following URL: http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42014009826

Eligibility criteria

Eligible participants and care settings

The included studies will comprise diverse stakeholders such as health care and medical professionals, patients, carers, facility managers and national authorities responsible for exchange of health information. All health care settings (primary, secondary and tertiary care) and agencies will be considered, but only in LMIC as defined by the WB.

Eligible interventions

Any study included in the review must relate to health information transmitted or exchanged electronically within and across organisations (e.g. hospitals and clinics), located within the same or different regions (e.g. within city or inter-city transfer) or at the national level. Health information may include patients' clinical data, demographics, health records, claims and administrative data.

The study will include components of HIE responsible for sharing and exchanging data. It will include electronic health records (EHR), EMR, personal health records, HIS, hospital information systems, hospital information management systems, hospital

management system and regional health information organisations, synonyms of HIE (clinical information exchange, health care information exchange, electronic document exchange and medical data exchange), health information infrastructure, and e-mail. It will also include legacy means of exchanging health information by electronic means such as telephone and fax.

Outcome measures
Primary outcome: We are interested in the identification of and an appreciation of barriers and facilitators to electronic HIE in LMIC. These may be operating at the individual, organisational, community, regional or national level. They could be technical, economic, cultural or organisational.

Secondary outcome: Identification of important research gaps in relation to barriers/facilitators to HIE.

Eligible study designs
Published, unpublished or on-going qualitative, quantitative and mixed methods studies designed with the purpose of examining barriers or facilitators to the development and adoption or use of electronic systems for exchanging patient or administrative data within or across parts of a health care delivery system will all be of potential interest. Published reports other than journal papers will also be included. We are mindful that 'barriers and facilitators' may also be described in other ways, such as 'influences on adoption' and 'implementation factors', or in terms of organisational adaptation or change management.

Search methods
The searches will not be restricted by language, data or publication status. Where relevant, papers will be translated into English. We will search the literature from January 1990 to July 2014 for research investigating problems and challenges in exchanging health information. This start date has been chosen because it was the time when policy makers and researchers became interested in problems associated with HIS, a component of HIE, in developing countries.[30–32] Experts will also be contacted for unpublished/in-progress research.

Electronic searches
We will search the published and unpublished/in-progress studies in the following electronic databases:

- MEDLINE
- EMBASE
- ISI Web of Science: Science Citation Index Expanded (SCI-EXPANDED)
- CINHAL Plus
- PakMediNet
- IndMED
- Global Health
- Global Health Library (Regional Indexes and WHOLIS)
- African Index Medics
- KoreaMed
- Google Scholar

WHO's and related websites such as WHO HMN will be used to identify reports.

Search strategy
Different search strategies have been designed for the above databases (see Appendix 1 for complete details).

Study selection
Two investigators will check titles and abstracts of the studies resulting from all database searches. These two investigators will independently assess the full text of all retrieved, potentially suitable studies against the above criteria. Further, the investigators will include only those studies in the set that will satisfy the inclusion criteria. Any disagreements between the investigators will be resolved by discussion and, if need arises, the third member of the research team will be called upon as a referee. EndNote program will be used to store and de-duplicate the studies.

Data extraction
The two independent reviewers will abstract the data onto a customised data extraction sheet (Appendix 2). Any conflicting views will be addressed through discussion, with final decision made by a third reviewer, if required. Variables to be extracted will be tabulated and will include author, year of publication, title of the study, country of origin, health care setting, participants, sample size, methodology, data collection, technology, intervention, data collection tool, associated barriers and facilitators.

Quality assessment
The quality assessment tool, Mixed Method Appraisal Tool version 2011, developed by Pluye, Gagnon (2) will be used to appraise the quality of qualitative, quantitative and mixed methods studies (Appendix 3). This tool has been used in many systematic reviews[34–36] dealing with mixed methods studies. The two reviewers will independently assess the quality of the included studies. Any contrary opinion will be settled through discussions. The third reviewer will be involved as an arbitrator, if agreement cannot be reached through discussion.

Data analysis
Owing to the likely heterogeneity of study designs, types of systems studied, varieties of barriers and facilitators examined, study populations and context, the results will be analysed descriptively rather than quantitatively, and synthesised narratively on the basis of the themes represented in the included studies.

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APPENDIX 1

MEDLINE/EMBASE/Global Health

1. algeria/ or egypt/ or libya/ or morocco/ or tunisia/ or cameroon/ or central african republic/ or chad/ or congo/ or "democratic republic of the congo"/ or comoros/ or gabon/ or burundi/ or djibouti/ or eritrea/ or ethiopia/ or kenya/ or rwanda/ or somalia/ or sudan/ or tanzania/ or uganda/ or angola/ or botswana/ or lesotho/ or malawi/ or mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or benin/ or burkina faso/ or cape verde/ or cote d'ivoire/ or gambia/ or ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/ or senegal/ or sierra leone/ or togo/ or "antigua and barbuda"/ or cuba/ or dominica/ or dominican republic/ or grenada/ or haiti/ or jamaica/ or fiji/ or "american samao"/ or saint lucia/ or "saint vincent and the grenadines"/ or belize/ or costa rica/ or el salvador/ or guatemala/ or honduras/ or nicaragua/ or panama/ or "gulf of mexico"/ or maldives/ or mexico/ or argentina/ or bolivia/ or brazil/ or chile/ or colombia/ or ecuador/ or marshall islands/ or guyana/ or paraguay/ or peru/ or suriname/ or uruguay/ or venezuela/ or kazakhstan/ or kyrgyzstan/ or tajikistan/ or turkmenistan/ or uzbekistan/ or russia/ or micronesia/ or cambodia/ or papua new guinea/ or indonesia/ or laos/ or malaysia/ or samao/ or myanmar/ or philippines/ or thailand/ or vietnam/ or bangladesh/ or bhutan/ or india/ or afghanistan/ or iran/ or iraq/ or jordan/ or lebanon/ or syria/ or turkey/ or yemen/ or nepal/ or pakistan/ or sri lanka/ or china/ or "democratic people's republic of korea"/ or mongolia/ or albania/ or latvia/ or lithuania/ or bosnia-herzegovina/ or bulgaria/ or kosovo/ or "macedonia (republic)"/ or moldova/ or montenegro/ or "republic of belarus"/ or romania/ or serbia/ or ukraine/ or armenia/ or azerbaijan/ or "georgia (republic)"/ or "sao tome and principe"/ or seychelles/ or timor-leste/ or tongo/ or tuvalu/ or vanuatu/ or "west bank and gaza".mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

2. Hospital Information Systems/ or Medical Records Systems, Computerized/ or Medical Record Linkage/ or Information Systems/ or Electronic Health Records/

3. (health information exchange* or healthcare information exchange* or clinical data exchange* or regional health information organization* or local health information organization* or personally controlled health record* or personally-controlled health record* or regional health information or regional health information exchange* or regional health information infrastructure* or regional health information network* or regional health information organization* or rhio or regional health information system* or local health information or local health information exchanges or local health information infrastructure or local health information system or local health infrastructure or local health initiatives

or local health institutions or healthcare information organization* or healthcare information exchange or medical information exchange or medical document exchange or personal health record* or electronic medical record*). mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

4. (health information system* or hospital information management system* or hospital management information system* or health infrastructure* or health network* or district health information system* or District Health Management Information System* or healthcare information system* or personal health record* or electronic medical record*). mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

5. ((patient record or medical record or electronic health record or health information) adj3 (exchange* or shar* or access)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

6. ((third world or emerging or low or middle or resource-poor) adj3 (countr* or nation* or setting*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

7. Developing Countries/

8. (Barrier$ or Hurdle or barricade* or Promot$ or Obstruct$ or Facilitat$ or Support$ or Cause$ or Encourag$ or challeng* or problem* or threat*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

9. (exchange* or shar* or access* or transfer* or transmission or mov*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

10. 1 or 6 or 7

11. 2 or 4

12. 9 and 11

13. 3 or 5 or 12

14. 8 and 10 and 13

15. limit 14 to yr="1990 -Current"

Web of Science/PakMediNet/IndMED/KoreaMed/African Index Medicus

Free-Field Format

1. ("third world" or "emerging" or "low-income" or "middle-income" or "resource-poor" or "developing") AND (countr* or "nation" or setting*)

AND

2. (Barrier$ or Hurdle or barricade* or Promot$ or Obstruct$ or Facilitat$ or Support$ or Cause$ or Encourag$ or challeng* or problem* or threat*)

AND

3. ("health information exchange*" or "healthcare information exchange*" or "clinical data exchange*" or "regional health information organization*" or "local health information organization*" or "personally controlled health record*" or "personally-controlled health record*" or "regional health information" or "regional health information exchange*" or "regional health information infrastructure*" or "regional health information network*" or "regional health information organization*" or "rhio" or "regional health information system*" or "local health information" or "local health information exchanges" or "local health information infrastructure" or "local health information system" or "local health infrastructure" or "local health initiatives" or "local health institutions" or "healthcare information organization*" or "healthcare information exchange" or "medical information exchange" or "medical document exchange" or "health information system*" or "hospital information management system*" or "hospital management information system*" or "health infrastructure*" or "health network*" or "district health information system*" or "District Health Management Information System*" or "healthcare information system*" or "personal health record*" or "electronic medical record*" or "patient record" or "medical record" or "electronic health record" or "health information")

AND

4. (exchange* or shar* or access* or transfer* or transmission or mov*)

Google Scholar/Global Health Library

health information exchange or barriers or facilitators or low-income or developing countries

APPENDIX 2

Data Extraction Sheet

Author/study	
Country of study	
Language	
Health care setting	
Technology (e.g., nursing information systems, NIS)	
Intervention, e.g. nurses using NIS	
Methodology/design	
Participants/sample size	
Data collection tool	
Barriers	
Facilitators	

APPENDIX 3

A scoring system for mixed methods research and mixed studies reviews[33]

Types of mixed methods study components or primary studies	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	Are there clear qualitative and quantitative research questions (or objectives*), or a clear mixed methods question (or objective*)?				
	Do the collected data allow address the research question (objective)? (E.g., consider whether the follow-up period is long enough for the outcome to occur (for longitudinal studies or study components)).				
Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.					
1. Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?				
	1.2. Is the process for analysing qualitative data relevant to address the research question (objective)?				
	1.3. Is appropriate consideration given to how findings relate to the context, e.g. the setting, in which the data were collected?				
	1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g. through their interactions with participants?				
2. Quantitative randomised controlled (trials)	2.1. Is there a clear description of the randomisation (or an appropriate sequence generation)?				
	2.2. Is there a clear description of the allocation concealment (or blinding when applicable)?				
	2.3. Are there complete outcome data (80% or above)?				
	2.4. Is there low withdrawal/drop-out (below 20%)?				
3. Quantitative nonrandomised	3.1. Are participants (organisations) recruited in a way that minimises selection bias?				
	3.2. Are measurements appropriate (clear origin, or validity known, or standard instrument; and absence of contamination between groups when appropriate) regarding the exposure/intervention and outcomes?				
	3.3. In the groups being compared (exposed vs. non-exposed; with intervention vs. without; cases vs. controls), are the participants comparable, or do researchers take into account (control for) the difference between these groups?				
	3.4. Are there complete outcome data (80% or above), and, when applicable, an acceptable response rate (60% or above), or an acceptable follow-up rate for cohort studies (depending on the duration of follow-up)?				

4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)?				
	4.2. Is the sample representative of the population under study?				
	4.3. Are measurements appropriate (clear origin, or validity known, or standard instrument)?				
	4.4. Is there an acceptable response rate (60% or above)?				
5. Mixed methods	5.1. Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?				
	5.2. Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?				
	5.3. Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?				
	Criteria for the qualitative component (1.1 to 1.4), and appropriate criteria for the quantitative component (2.1 to 2.4, or 3.1 to 3.4, or 4.1 to 4.4), must be also applied				

*These two items are not considered as double-barrelled items since in mixed methods research, (1) there may be research questions (quantitative research) or research objectives (qualitative research) and (2) data may be integrated, and/or qualitative findings and quantitative results can be integrated.