Going digital: a narrative overview of the clinical and organisational impacts of e-health technologies in hospital practice

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Item 1. Pre-specified PubMed search string for electronic health records

((health information exchange [tw] OR
hie [tw] OR
rhio [tw] OR
regional health information organization [tw] OR
hl7 [tw] OR
health level seven [tw] OR
unified medical language system [majr] OR
umls [tw] OR
loinc [tw] OR
rxnorm [tw] OR
snomed [tw] OR
icd9 cm [ti] OR
icd 9 cm [ti] OR
icd10 [ti] OR

icd 10 [ti] OR
metathesaurus [tw] OR
patient card [tw] OR
patient cards [tw] OR
health card [tw] OR
health cards [tw] OR
electronic health data [tw] OR
personal health data [tw] OR
personal health record [tw] OR
personal health records [tw] OR
Health Records, Personal [Majr] OR
Health Record, Personal [Majr] OR
ehealth [tw] OR
e-health [tw] OR
medical informatics application [mh] OR
medical informatics applications [mh] OR
medical records system, computerized [mh] OR
medical records systems, computerized [mh] OR
computerized patient medical records [tw] OR
automated medical record system [tw] OR
automated medical record systems [tw] OR
automated medical records system [tw] OR
automated medical records systems [tw] OR
computerized medical record [tw] OR
computerized medical records [tw] OR
computerized patient records [tw] OR
computerized patient record [tw] OR
computerized patient medical record [tw] OR
electronic health record [tw] OR
electronic health records [tw] OR
Electronic Health Record [Majr] OR
Electronic Health Records [Majr] OR
electronic patient record [tw] OR
electronic patient records [tw] OR
electronic medical record [tw] OR
electronic medical records [tw] OR
electronic healthcare records [tw] OR
electronic healthcare record [tw] OR
electronic health care record [tw] OR
electronic health care records [tw] OR
archives [majr] OR
ehr [tw] OR
ehrs [tw] OR
phr [tw] OR
phrs [tw] OR
emr [tw] OR
emrs [tw] OR
Health Information Systems [Majr])
AND
(medical record [ti] OR

medical records [mh] OR
medical records [ti] OR
patient record [ti] OR
patient records [ti] OR
patient health record [ti] OR
patient health records [ti] OR
patient identification system [mh] OR
patient identification systems [mh] OR
Patient Outcome Assessment[Majr] OR
Patient Discharge Summaries[Majr] OR
healthcare record [ti] OR
healthcare records [ti] OR
health care record [ti] OR
health care records [ti] OR
health record [ti] OR
health records [ti] OR
hospital information system [tw] OR
hospital information systems [tw] OR
umae [ti] OR
attitude to computers [mh] OR
medical informatics [ti]))
OR
((medical records systems, computerized [majr] OR
medical records systems, computerized [mh] OR
computerized patient medical record [tw] OR
computerized patient medical records [tw] OR
automated medical record system [tw] OR
automated medical record systems [tw] OR
automated medical records system [tw] OR
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electronic health record [tw] OR
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unified medical language system [majr] OR
unified medical language system [tw] OR
umls [tw] OR
loinc [tw] OR
rxnorm [tw] OR
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icd9 cm [ti] OR
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icd10 [ti] OR
icd 10 [ti] OR
metathesaurus [tw] OR
ehr [tw] OR
ehrs [tw] OR
phr [tw] OR
phrs [tw] OR
emr [tw] OR
emrs [tw] OR
meaningful use [tiab] OR
meaningful use [tw] OR
Meaningful Use [Majr])
AND
(j ahima [ta] OR
j am med inform assoc [ta] OR
amia annu symp proc [ta] OR
health data manag [ta] OR
int j med inform [ta] OR
yearb med inform [ta] OR
telemed j e health [ta] OR
stud health technol inform [ta]))

Item 2: Study inclusion and exclusion criteria

Included studies:
- use of computers in information exchange

- electronic health records

- computer-based history taking systems

- electronic booking systems and electronic referral systems

- computerised decision support systems

- artificial intelligence in healthcare (relevant to computerised decision support systems)

- computerised reminders in clinical practice

- computer-aided detection or diagnosis in medical imaging

- decision support for ePrescribing and other orders

- human factors related to computing in healthcare

Excluded studies:
- computer-assisted and any other type of IT enhanced surgery

- computer-assisted therapy predominantly directed at or used by patients independently or under supervision of a healthcare professional (eg smoking cessation, cognitive behaviour therapy)

- telemedicine

- eLearning (the use of electronic technology and media to deliver, support and enhance learning and teaching)

- consumer health informatics (patient-oriented eHealth)

- information literacy

- point-of-care testing without CDSS or with CDSS directed at patients.

- public health surveillance systems

- eHealth systems implemented in developing countries

- references not having an a priori IT focus or objective but that reported on IT post retrieval of references

- technologies (or studies) targeting only single class of diseases, single disciplines, single class of investigations or medications, or single vendor systems

- patient identification: bar-coding and biometric systems; biometric identification includes measuring and analysing human physical and behavioural characteristics for identification purposes

Item 3. Critical appraisal tool
Assessing the Methodological Quality of Systematic Reviews (AMSTAR) tool for systematic reviews
1. Was an 'a priori' design provided?
The research question and inclusion criteria should be established before the conduct of
the review.
*Note: Need to refer to a protocol, ethics approval, or pre-determined/a priori published
research objectives to score a "yes."*
□ Yes □ No □ Can't answer □ Not applicable

2. Was there duplicate study selection and data extraction?
There should be at least two independent data extractors and a consensus procedure for
disagreements should be in place.
*Note: 2 people do study selection, 2 people do data extraction, consensus process or one
person checks the other's work.*
□ Yes □ No □ Can't answer □ Not applicable

3. Was a comprehensive literature search performed?
At least two electronic sources should be searched. The report must include years and
databases used (e.g., Central, EMBASE, and MEDLINE). Key words and/or MESH terms
must be stated and where feasible the search strategy should be provided. All searches
should be supplemented by consulting current contents, reviews, textbooks, specialized
registers, or experts in the particular field of study, and by reviewing the references in
the studies found.
*Note: If at least 2 sources + one supplementary strategy used, select "yes" (Cochrane
register/Central counts as 2 sources; a grey literature search counts as supplementary).*
□ Yes □ No □ Can't answer □ Not applicable

**4. Was the status of publication (i.e. grey literature) used as an inclusion
criterion?**
The authors should state that they searched for reports regardless of their publication
type. The authors should state whether or not they excluded any reports (from the
systematic review), based on their publication status, language etc.
*Note: If review indicates that there was a search for "grey literature" or "unpublished
literature," indicate "yes." SIGLE database, dissertations, conference proceedings, and
trial registries are all considered grey for this purpose. If searching a source that contains
both grey and non-grey, must specify that they were searching for grey/unpublished lit.*
□ Yes □ No □ Can't answer □ Not applicable

5. Was a list of studies (included and excluded) provided?
A list of included and excluded studies should be provided.
*Note: Acceptable if the excluded studies are referenced. If there is an electronic link to
the list but the link is dead, select "no."*
□ Yes □ No □ Can't answer □ Not applicable

6. Were the characteristics of the included studies provided?
In an aggregated form such as a table, data from the original studies should be provided
on the participants, interventions and outcomes. The ranges of characteristics in all the
studies analyzed e.g., age, race, sex, relevant socioeconomic data, disease status,

duration, severity, or other diseases should be reported.
Note: Acceptable if not in table format as long as they are described as above.
□ Yes □ No □ Can't answer □ Not applicable

7. Was the scientific quality of the included studies assessed and documented?
'A priori' methods of assessment should be provided (e.g., for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.
Note: Can include use of a quality scoring tool or checklist, e.g., Jadad scale, risk of bias, sensitivity analysis, etc., or a description of quality items, with some kind of result for EACH study ("low" or "high" is fine, as long as it is clear which studies scored "low" and which scored "high"; a summary score/range for all studies is not acceptable).
□ Yes □ No □ Can't answer □ Not applicable

8. Was the scientific quality of the included studies used appropriately in formulating conclusions?
The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.
Note: Might say something such as "the results should be interpreted with caution due to poor quality of included studies." Cannot score "yes" for this question if scored "no" for question 7.
□ Yes □ No □ Can't answer □ Not applicable

9. Were the methods used to combine the findings of studies appropriate?
For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e., Chi-squared test for homogeneity, I2). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e., is it sensible to combine?).
Note: Indicate "yes" if they mention or describe heterogeneity, i.e., if they explain that they cannot pool because of heterogeneity/variability between interventions.
□ Yes □ No □ Can't answer □ Not applicable

10. Was the likelihood of publication bias assessed?
An assessment of publication bias should include a combination of graphical aids (e.g., funnel plot, other available tests) and/or statistical tests (e.g., Egger regression test, Hedges-Olken).
Note: If no test values or funnel plot included, score "no". Score "yes" if mentions that publication bias could not be assessed because there were fewer than 10 included studies.
□ Yes □ No □ Can't answer □ Not applicable

11. Was the conflict of interest included?
Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.
Note: To get a "yes," must indicate source of funding or support for the systematic review AND for each of the included studies.
□ Yes □ No □ Can't answer □ Not applicable