SECOND PRESENTATION

ARTIFICIAL INTELLIGENCE SYSTEMS FOR CRITICAL CARE: A SYSTEMATIC REVIEW
Are artificial intelligence (AI) systems used and useful when applied to critical care?
Introduction

Previously…

Artificial intelligence applications in the intensive care unit [1]

At the rate that technology changes and the rate our knowledge evolves…

Enough time has passed to ensure that there is a necessity for a new review

[1] Hanson CW 3rd, Marshall BE; Artificial intelligence applications in the intensive care unit; Critical care medicine; 2001 Feb; 29 (2); 427-35
Introduction

AI: Definition

“Medical artificial intelligence is primarily concerned with the construction of AI programs that perform diagnosis and make therapy recommendations.” [2]

AI in medicine

AI in medicine appeared as an answer to an evolving problem – the escalating amount of information that doctors have to deal with everyday.

Introduction

Intensive Care Unit: Definition

An intensive care unit (ICU) is a specialized department in hospitals that provides life support or organ support systems in patients who are critically ill and who usually require constant monitoring.

Critical care is the permanent and thorough care provided to the critical patients in intensive care units.
Introduction

AI and ICU

- Intensive care medicine frequently involves making rapid decisions on the basis of a large and disparate array of information [3].

- Since the technology of monitoring astronauts’ vital signs in space was transferred to the bedside in the 1960s, patient monitoring systems have become an indispensable part of critical care [4].

- Today, with more biosensors and computational power, these systems can simultaneously gather and display multiple physiological signals, derive clinically important parameters, and generate alerts to clinicians[4].

Introduction

Important concepts related to Artificial Intelligence: [1]

- Management information system (MIS)
- Data Stream
- Rule-Based (Expert) Systems
- Data Mining
- Neural Networks
- Machine Learning
- Case-Based Reasoning
- Data Visualization

[1] Hanson CW 3rd, Marshall BE; Artificial intelligence applications in the intensive care unit; Critical care medicine; 2001 Feb; 29 (2); 427-35
To review the current applications of artificial intelligence in critical care.
Specific Objectives

• To investigate if artificial intelligence systems are currently being used for critical care.

• To study the benefits and drawbacks of artificial intelligence systems for critical care when compared to non AI-methods.
Specific Objectives

• To analyse the use of artificial intelligence systems as decision support mechanisms for critical care.

• To find out the level of acceptance of artificial intelligence systems by the health professionals.
Methods

Study design:

Systematic review

- 1- An exhaustive search, in electronic databases, and inclusion of primary studies.

- 2- Quality assessment of included studies and data extraction (review, by two persons, of the title and the abstract or the article. Same process for the full article. A third opinion may be requested).

- 3- Synthesis of study results (SPSS and Review Manager).

- 4- Interpretation of results and report writing.
Methods

Study participants:

→ Target population

Articles which report AI applications in the intensive care unit
Methods

Data collection methods:

→ Search strategy

Articles are searched in:

- PubMed;
- ISI Web of Knowledge;
- SCOPUS.

The query is based in the following keywords: **AI** and (**critical care** or **ICU**).
Methods

Query terms:

**Artificial intelligence:** Computer reasoning, machine intelligence, machine learning, computer vision system, knowledge acquisition, fuzzy logic, expert systems, knowledge bases, neural networks (computer), neural network model, perceptron, direct support system, robotic, telerobotic;

**Intensive care unit:** Critical care (unit), surgical intensive care (unit), neonatal intensive care (unit), infant newborn intensive care (unit), pediatric intensive care unit, ICU, PICU, NICU, CC, burn(s) unit, respiratory care unit, coronary care unit.
Methods

Data collection methods:

→ Study selection

All citations (titles and abstracts) are saved in *Jabref*.

Two reviewers select articles appropriate for inclusion in review.

According to **Inclusion Criteria**

Exclusion Criteria

Disagreements regarding eligibility are resolved with a third reviewer through consensus.

After obtaining full reports of potentially relevant articles, the same reviewers independently assess eligibility from full-text articles.
Methods

Inclusion/ exclusion criteria:

Inclusion criteria (according to PICO)

1. Study design (clinical trials, cohort or case-control);
2. Study participants of included articles are patients in the intensive care unit;
3. Studies that describe intervention on monitoring, warning (alert), decision support or prescription support;
4. Study outcomes include mortality, morbidity, quality of life, length of stay or other patient outcomes.

Exclusion criteria
Articles that use data from the ICU as secondary data for the demonstration of AI systems based only on system's performance outcomes.
Methods

Data collection methods

→ Data extraction

Reviewer A
Articles included by reviewer A

Reviewer B
Articles included by reviewer B

Extraction of data according to study variables

Relevant information is introduced in SPSS

If there are multiple reports for a particular study, data from the most complete version is privileged

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09-12-2009
Data collection methods

→ Validity assessment

During the data extraction process, the articles which information shows loss of follow-up, use of blinding or allocation concealment must be excluded and reported in results. The exclusion of articles based on the presence of diverse bias types could be done according Cochrane Handbook of systematic reviews guideline.
Study variables:

- Characteristics of the articles (year, author and country of publishing, etc…)
- Type of study (number of participants, duration, etc…)
- Domain of application (neurological, respiratory, cardiovascular, etc…)
- Area of application (monitoring, alerting, decision supporting, etc..)
Methods

Statistical analysis:

• Analysis of the study variables using the appropriate frequency measures;

• Possible associative analysis between factors and outcomes in the cases in which such aspects are included, resorting to adequate association measures.
Search Results

Pubmed

<table>
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<th>Search Query</th>
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<td>AI</td>
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<tr>
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<tr>
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ISI

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<tr>
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SCOPUS

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<tr>
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<tr>
<td>AI</td>
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</tr>
</tbody>
</table>
Expected Results

• Description of few systems that apply artificial intelligence in intensive care units;

• Reduced acceptance;

• Greater number of benefits when compared to the drawbacks.
References

[1] Hanson CW 3rd, Marshall BE; Artificial intelligence applications in the intensive care unit; Critical care medicine; 2001 Feb; 29 (2); 427-35

