

CADTH RAPID RESPONSE REPORT: SUMMARY OF ABSTRACTS

# Computerized Provider Order Entry Systems for Laboratory and Diagnostic Tests: Clinical Effectiveness, Cost-Effectiveness, and Guidelines

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## Research Questions

1. What is the clinical effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests?
2. What is the cost-effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests?
3. What are the evidence-based guidelines regarding the use of computerized provider order entry systems for the management of laboratory and diagnostic tests?

## Key Findings

One systematic review was identified regarding the clinical effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests. One economic evaluation was identified regarding the cost-effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests. No evidence-based guidelines were identified regarding the use of computerized provider order entry systems for the management of laboratory and diagnostic tests.

## Methods

### Literature Search Methods

A limited literature search was conducted by an information specialist on key resources including Medline via OVID, the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were CPOE systems and laboratory testing and diagnosis. Filters were applied to limit the retrieval to health technology assessments, systematic reviews, and meta analyses, randomized controlled trials, and non-randomized studies, economic studies, and guidelines. The search was also limited to English language documents published between January 1, 2015 and October 5, 2020. Internet links are provided where available.

### Selection Criteria and Summary Methods

One reviewer screened literature search results (titles and abstracts) and selected publications according to the inclusion criteria presented in Table 1. Full texts of study publications were not reviewed. The Overall Summary of Findings was based on information available in the abstracts of selected publications. Open access full-text versions of evidence-based guidelines were reviewed when abstracts were not available, and relevant recommendations were summarized.

**Table 1: Selection Criteria**

<b>Population</b>	Individuals with any medical condition
<b>Intervention</b>	The ordering of laboratory and diagnostic tests with computerized provider order entry systems
<b>Comparator</b>	Q1-Q2: Alternative methods for the ordering of laboratory and diagnostic tests (e.g., paper-based systems) Q3: Not applicable

<b>Outcomes</b>	Q1: Clinical effectiveness (e.g., incidence of medical errors, patient safety [e.g., rates of adverse drug events]) Q2: Cost-effectiveness (e.g., cost per quality-adjusted life-year gained) Q3: Recommendations regarding best practices (e.g., implementation considerations, health system considerations, appropriate clinical settings)
<b>Study Designs</b>	Health technology assessments, systematic reviews, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines

## Results

One systematic review<sup>1</sup> was identified regarding the clinical effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests. One economic evaluation<sup>2</sup> was identified regarding the cost-effectiveness of computerized provider order entry systems for the management of laboratory and diagnostic tests. No relevant health technology assessments, randomized controlled trials, or non-randomized studies were identified. No evidence-based guidelines were identified regarding the use of computerized provider order entry systems for the management of laboratory and diagnostic tests.

Additional references of potential interest that did not meet the inclusion criteria are provided in the appendix.

## Overall Summary of Findings

The authors of the systematic review<sup>1</sup> found that a computerized clinical decision support system targeted at ordering laboratory tests within a computerized physician order entry system had little to no effect on clinical outcomes but had some effect on compliance. However, no results specific to the effectiveness of computerized provider order entry systems with a built-in computerized clinical decision support system were available in the abstract.<sup>1</sup> The authors of the economic evaluation<sup>2</sup> found that in comparison to a paper-based system, a computerized physician order entry system with a clinical decision support system yielded savings in hospital costs and improvements in quality-adjusted life-years.

## References Summarized

### Health Technology Assessments

No literature identified.

### Systematic Review and Meta-analyses

1. Delvaux N, Van Thienen K, Heselmans A, de Velde SV, Ramaekers D, Aertgeerts B. The Effects of computerized clinical decision support systems on laboratory test ordering: a systematic review. *Arch Pathol Lab Med.* 2017 Apr;141(4):585-595.  
[PubMed: PM28353386](#)

### Randomized Controlled Trials

No literature identified.

## Non-Randomized Studies

No literature identified.

## Economic Evaluation

2. Nuckols TK, Asch SM, Patel V, et al. Implementing computerized provider order entry in acute care hospitals in the United States could generate substantial savings to society. *Jt Comm J Qual Patient Saf.* 2015 Aug;41(8):341-350.  
[PubMed: PM26215523](#)

## Guidelines and Recommendations

No literature identified.

## Appendix — Further Information

### Previous CADTH Report

3. Wells C, Loshak H. Standardized hospital order sets in acute care: a review of clinical evidence, cost-effectiveness, and guidelines (*CADTH Rapid response report: summary with critical appraisal*). Ottawa (ON): CADTH; 2019 Jul: <https://www.cadth.ca/sites/default/files/pdf/htis/2019/RC1147%20Standardized%20Order%20Sets%20Final.pdf> Accessed 2020 Oct 13.

### Health Technology Assessment

#### *Unclear Intervention – CPOE Lab and Diagnostic Test Orders not Specified*

4. Health Improvement Scotland. Knowledge-based clinical decision support systems [*SHTG assessment*]. Edinburgh, Scotland: Health Improvement Scotland; 2020 Apr: [http://www.healthcareimprovementscotland.org/our\\_work/technologies\\_and\\_medicines/topics\\_assessed/assessment\\_02-20.aspx?theme=mobile](http://www.healthcareimprovementscotland.org/our_work/technologies_and_medicines/topics_assessed/assessment_02-20.aspx?theme=mobile) Accessed 2020 Oct 13.

### Systematic Reviews and Meta-Analyses

#### *Unclear Intervention – CPOE Lab and Diagnostic Test Orders not Specified*

5. Carli D, Fahrni G, Bonnabry P, Lovis C. Quality of decision support in computerized provider order entry: systematic literature review. *JMIR Med Inform*. 2018 Jan 24;6(1):e3. [PubMed: PM29367187](#)

#### *Unclear Outcomes*

6. Rubinstein M, Hirsch R, Bandyopadhyay K, et al. Effectiveness of practices to support appropriate laboratory test utilization: a laboratory medicine best practices systematic review and meta-analysis. *Am J Clin Pathol*. 2018 Feb 17;149(3):197-221. [PubMed: PM29471324](#)

### Non-Randomized Studies

#### *Alternative Intervention*

7. Lewkowicz D, Wohlbrandt A, Boettinger E. Economic impact of clinical decision support interventions based on electronic health records. *BMC Health Serv Res*. 2020 Sep 15;20(1):871. [PubMed: PM32933513](#)
8. Rodriguez-Borja E, Corchon-Peyrallo A, Diaz-Gimenez M, et al. Computer physician order entry (CPOE) as a strategy to estimate laboratory activity and costs associated with cancer clinical trials. *Biochem Med*. 2018 Oct 15;28(3):030706. [PubMed: PM30429674](#)

9. Bellodi E, et al. Economic and organizational impact of a clinical decision support system on laboratory test ordering. *BMC Med Inform Decis Mak.* 2017 Dec 22;17(1):179. <https://pubmed.ncbi.nlm.nih.gov/29273037/>

### *No Comparator*

10. Tamburrano A, Vallone D, Carrozza C, et al. Evaluation and cost estimation of laboratory test overuse in 43 commonly ordered parameters through a Computerized Clinical Decision Support System (CCDSS) in a large university hospital. *PLoS ONE.* 2020 Aug 6;15(8):e0237159.

### *Alternative Outcome*

11. Juskewitch JE, Norgan AP, Johnson RD, Trivedi VA, Hanson CA, Block DR. Impact of an electronic decision support rule on ESR/CRP co-ordering rates in a community health system and projected impact in the tertiary care setting and a commercially insured population. *Clin Biochem.* 2019 Apr;66:13-20.  
[PubMed: PM30711389](#)

### *Unclear Comparator*

12. Goldszer RC, Ratzan K, Csete M, et al. Impact of order set use on outcome of patients with sepsis. *Appl Inform.* 2017 Jan;4(2).  
<https://link.springer.com/article/10.1186/s40535-016-0033-y>  
Accessed 2020 Oct 13.

### *Review Articles*

13. Bindraban RS, Ten Berg MJ, Naaktgeboren CA, et al. Reducing test utilization in hospital settings: a narrative review. *Ann Lab Med.* 2018 Sep;38(5):402-412.  
[PubMed: PM29797809](#)
14. Jackups Jr. R, et al. Clinical decision support for hematology laboratory test utilization. *Int J Lab Hem.* 2017 May;39 Suppl 1:128-135.  
[PubMed: PM28447421](#)
15. Keasberry J, Scott IA, Sullivan C, Staib A, Ashby R. Going digital: a narrative overview of the clinical and organisational impacts of eHealth technologies in hospital practice. *Aust Health Rev.* 2017 Dec;41(6):646-664.  
[PubMed: PM28063462](#)
16. Yap G, Melder A. Reducing costs in hospitals. Melbourne, Australia: Rapid Review Centre for Clinical Effectiveness, Monash Health; 2019 Jun:  
<https://monashhealth.org/wp-content/uploads/2019/06/Reducing-costs-in-hospitals-review-23052019.pdf> Accessed 2020 Oct 13.  
*See: Principle 2: Infrastructure fundamentals study #1, p. 6*
17. Jalbert R, Gob A, Chin-Yee I. Decreasing daily blood work in hospitals: what works and what doesn't. *Int J Lab Hematol.* 2019 May;41 Suppl 1:151-161.  
[PubMed: PM31069984](#)