

Automatic identification of comparative effectiveness research from Medline citations to support clinicians' treatment information needs

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Information needs

Questions left unanswered at point of care (*Del Fiol, 2012*)



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1. [Cross-national comparisons of gender differences in late-life depressive symptoms in Japan and the United States.](#)
Tiedt AD.
J Gerontol B Psychol Sci Soc Sci. 2013 May;68(3):443-54. doi: 10.1093/geronb/gbt013. PMID: 23591572 [PubMed - indexed for MEDLINE] [Related citations](#)
2. [Widowhood and depression among older Europeans--the role of gender, caregiving, marital quality, and regional context.](#)
Schaan B.
J Gerontol B Psychol Sci Soc Sci. 2013 May;68(3):431-42. doi: 10.1093/geronb/gbt015. PMID: 23591574 [PubMed - indexed for MEDLINE]

Comparative effectiveness studies

One common information need:
Compare available treatment (*Ely, 2000*)



Display Settings: Abstract

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[Dis Nerv Syst](#). 1977 Oct;38(10):785-9.

Which tricyclic for depressed outpatients, imipramine pamoate or amitriptyline?

[Goldberg HL](#), [Finnerty RJ](#).

Abstract

Fifty-seven neurotically depressed outpatients with sleep disturbance were randomly assigned to treatment with either imipramine pamoate or amitriptyline given in a single dose at bedtime in a double-blind study for four weeks. The results indicate that both imipramine pamoate and amitriptyline are equally effective in treating neurotic depression. The clinical lore that imipramine is more effective for retarded depression and amitriptyline for anxious, agitated depression was not supported by this study. Of special interest is the fact that the imipramine pamoate group had significantly earlier rising times, and a trend toward better quality of sleep. The side effect profiles of the two drugs were also remarkably similar in this population though more patients complained of side effects on amitriptyline than on imipramine.

PMID: 332472 [PubMed - indexed for MEDLINE]

[Am Heart J](#). 2007 May;153(5):868-73.

A double-blind placebo-controlled pilot study of controlled-release paroxetine on depression and quality of life in chronic heart failure.

[Gottlieb SS](#), [Kop WJ](#), [Thomas SA](#), [Katzen S](#), [Vesely MR](#), [Greenberg N](#), [Marshall J](#), [Cines M](#), [Minshall S](#).

University of Maryland School of Medicine and the Baltimore VAMC, Baltimore, MD, USA. sgottlieb@medicine.umaryland.edu

Abstract

BACKGROUND: Depression is frequently observed in patients with heart failure and is associated with poor quality of life and adverse prognosis. However, the prevalence of depression in heart failure could be overestimated because symptoms of depression overlap with those of heart failure. Similarly, the importance of depression may be overestimated if depression merely reflects worse heart failure. Because the response to depression treatment has not been evaluated in this patient population, we evaluated the efficacy of controlled-release paroxetine (paroxetine CR), a selective serotonin reuptake inhibitor, on depression and quality of life in chronic heart failure.

METHODS: A double-blind, randomized, placebo-controlled design was used to evaluate reductions in depression following 12 weeks of treatment with paroxetine CR (n = 14, age 62.1 +/- 12.3 years) or placebo (n = 14, age = 61.9 +/- 9.0 years). Patients with symptomatic congestive heart failure and a score of at least 10 on the Beck Depression Inventory (BDI) were eligible. Beck Depression Inventory was obtained at baseline and 4, 8, and 12 weeks of follow-up. Quality of life was assessed using the Medical Outcomes Study Short Form and the Minnesota Living with Heart Failure Questionnaire.

Information needs

Questions left unanswered at point of care (*Del Fiol, 2012*)

Too many ????



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[Related citations](#)
2. [Widowhood and depression among older Europeans—the role of gender, caregiving, marital quality, and regional context.](#)
Schaan B.
J Gerontol B Psychol Sci Soc Sci. 2013 May;68(3):431-42. doi: 10.1093/geronb/gbt015.
PMID: 23591571 [PubMed - indexed for MEDLINE]
[Related citations](#)

Comparative effectiveness studies

One common information need:
Compare available treatment (*Ely, 2000*)

Goal

- Use text summarization to help clinicians meet their information needs
- Design and assess algorithm to automatically summarize comparative effectiveness studies
 - Identify studies
 - Extract interventions

Method

- Algorithm Description

Retrieve
citations
from
Medline



Extract
SemMedDB
predications

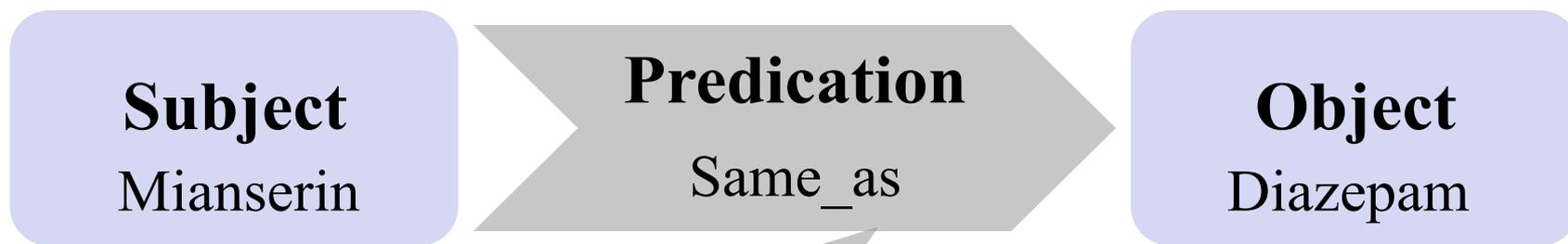
Knowledge summary system

- Multiple NLP tools
- Extract sentence related to treatment
- Precision : 91% --Alzheimer's disease and depression (Jonnalagadda, 2012)

SemMedDB

(Kilicoglu, 2012)

- Semantic MEDLINE database (SemMedDB)



In a third trial, mianserin was found to be as effective as diazepam in the treatment of anxiety states in general practice.

- Treats

Method

- Algorithm Description

Retrieve
citations
from
Medline

Extract
SemMedDB
predications

Extract
Medline
citation
fields



Background

- Example of a Medline metadata fragment

```
<PublicationTypeList>
```

```
  <PublicationType>Clinical Trial</PublicationType>
```

```
  <PublicationType>Comparative Study</PublicationType>
```

```
  <PublicationType>Journal Article</PublicationType>
```

```
</PublicationTypeList>
```

```
...
```

```
<ChemicalList>
```

```
  <Chemical>
```

```
    <RegistryNumber>79617-96-2</RegistryNumber>
```

```
    <NameOfSubstance>Sertraline</NameOfSubstance>
```

```
  </Chemical>
```

```
</ChemicalList>
```

Method

Retrieve citations from Medline

Extract SemMedDB predications

Extract Medline citation fields

Comparative study classifier

Identify study interventions

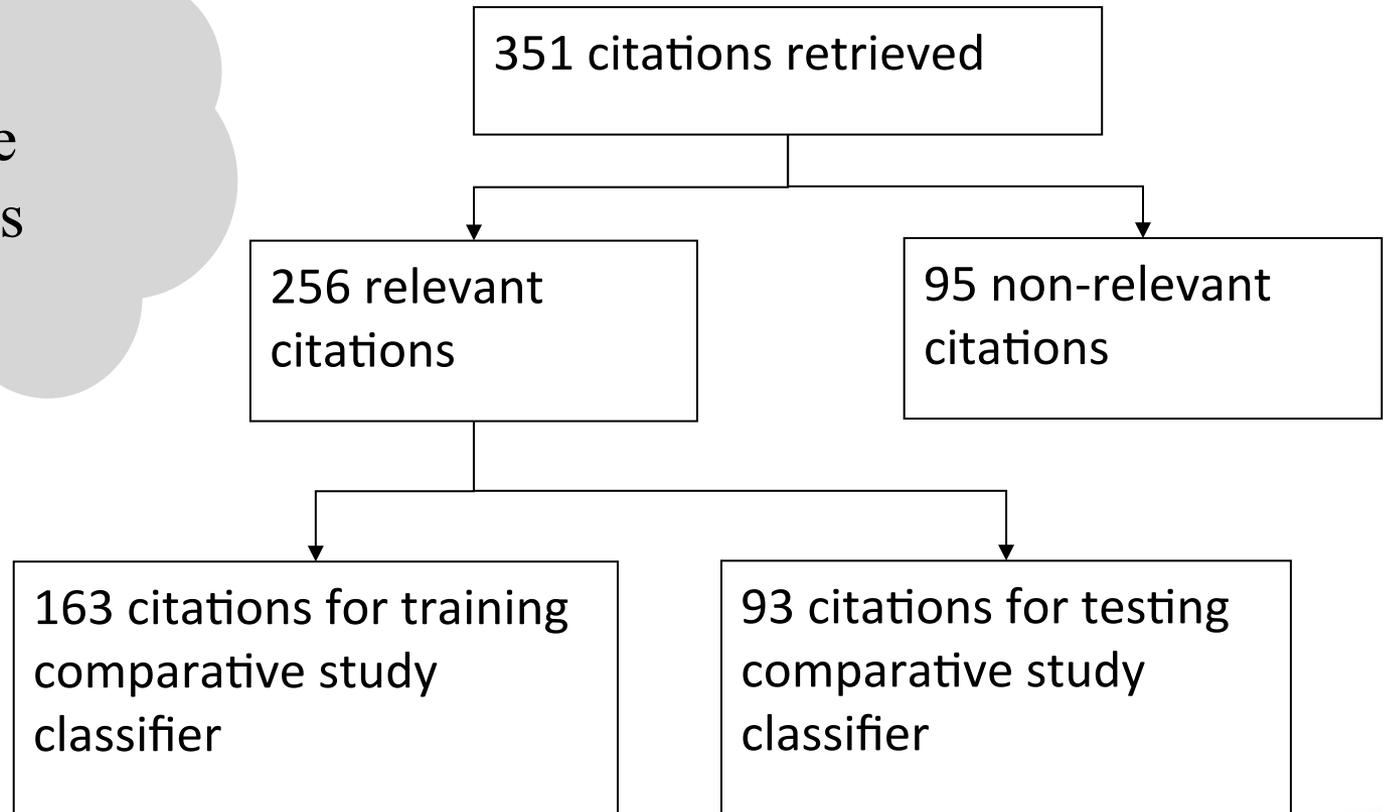
Five predictors

- Publication type
- Number of interventions
 - Chemical list
 - Comparative predications
 - Treats predications
 - Total across data sources
 - Support Vector Machine

- Merge interventions from
 - SemMedDB
 - Medline chemical list

Gold Standard

- Relevant
- Comparative
- Interventions
- Direction



Evaluation

Retrieve citations from Medline

Extract SemMedDB predications

Extract Medline citation fields

Comparative study classifier

Identify study interventions

Intervention

- Precision
 - Recall
 - F₁
 - AUROC
- Percentage of completely matched
 - Percentage of partially or completely matched

Direction

- Recall
- Precision

Results

- Performance of the comparative classifiers

	Precision	Recall	F-measure	AUC
Publication Type	0.77	0.58	0.66	N/A
Naïve Bayes	0.83	0.83	0.82	0.90
Bayesian net	0.82	0.82	0.82	0.89
PART	0.83	0.83	0.83	0.76
J48	0.82	0.82	0.82	0.82
SVM	0.75	0.75	0.75	0.73

Results

Retrieve citations from Medline

Extract SemMedDB predications

Extract Medline citation fields

Comparative study classifier

Identify study interventions

Intervention

- 56.2% (41 out 73) completely
- 86.2% (63 out 73) completely or partially

Direction

- Recall: 6.8%
- Precision: 45.5%

So What?

- Potential applications
 - Improve Pubmed's comparative study filter
 - Recall: 0.56 versus 0.83
 - Precision: 0.77 versus 0.83
 - Component of text summarization process to support point of care information needs

Mianserin

2 articles

Trazodone

The drug treatment of depression in general practice: a comparison of nocte administration of trazodone with mianserin, dothiepin and amitriptyline

[...] One hundred and twelve patients were randomised to receive trazodone therapy, 36 received mianserin, 35 received dothiepin and 44 received amitriptyline.

[...] No significant differences were shown, using any measure of efficacy, between trazodone and any of the three comparator drugs.

A double-blind controlled trial of mianserin and amitriptyline in depression

[...] A double-blind trial was carried out in 47 patients with depression to compare the effectiveness of 30 mg mianserin, 60 mg mianserin and 50 mg sustained-release amitriptyline, each given as a single dose at night over a period of 4 weeks.

[...] A consistent order of effectiveness was evident with most of the items, the greatest improvement being noted with 60 mg mianserin daily and the least with 30 mg mianserin daily.

Cognitive Therapy

Error analysis

- Combination therapy
 - Tryptophan+nicotinamide vs. tryptophan+nicotinamide+imipramine
- Different forms of the same drug/procedure
 - standard release vs. controlled-release
 - 30mg versus 60mg
- Non-pharmaceutical interventions
 - face-to-face vs. online therapy

Potential Solutions

- Explore MeSH Headings
 - Drug Therapy, Combination
- Clinical trial registries: ClinicalTrials.gov
- Coordinating constructions (*Chung, 2009*)



Limitations

- Generalizability
 - Assessed with one condition
- Limited to treatment
 - Needs to be adapted to other types of information need (e.g., comparison of diagnostic methods)

Conclusion

- The proposed algorithm achieved good performance
 - Identify comparative studies
 - Extract interventions
- Provides basis for automatic summarization of comparative effectiveness research to support point of care needs
- More test cases needed

Questions?

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