Critical Appraisal of Healthcare Research: Systematic Review

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SYSTEMATIC REVIEW

Types of Review Articles

- Meta-analyses
- Systematic reviews
- Individual patient data (IPD) meta-analyses
- Reviews that are not systematic (traditional, narrative reviews)

All reviews (also called overviews)

Purpose of Systematic Review

• Summarize results of multiple, well-designed studies

• Provide high-level evidence for decision making

• If studies are similar enough, then results can be combined to draw stronger conclusions (meta-analysis)
Systematic Review Process

- Methodical
  - Focused clinical question
- Objective
  - Exhaustive and detailed search
  - Detailed inclusion criteria
  - Independent review by multiple authors
Systematic Review Process

PRISMA Flow diagram

• Visual diagram of search and selection process

• Standard items reported in a systematic review

• Promotes transparency
Effectiveness of animal-assisted therapy: A systematic review of randomized controlled trials

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Available online 6 January 2014

KEYWORDS
animal-assisted therapy
Systematic review
randomized controlled trials

Summary
The objectives of this review were to summarize the evidence from randomized controlled trials (RCTs) on the effects of animal-assisted therapy (AAT). Studies were eligible if they were RCTs. Studies included one treatment group in which AAT was applied. We searched the following databases from January 1990 to October 31, 2012: MEDLINE via PubMed, CINAHL, Web of Science, Cinahl Plus, and PsycINFO. We also searched all conference databases up to October 31, 2012. Eleven RCTs were identified, and seven studies were about "mental and behavioral disorders." Types of animal intervention were dog, cat, dolphin, bird, cow, rabbit, ferret, and guinea pig. The RCTs conducted had a relatively low-quality. We did not perform meta-analysis because of heterogeneity.

In a study environment limited to the people who like animals, AAT may be an effective treatment for mental and behavioral disorders such as depression, schizophrenia, and alcohol drug addictions, and is based on a holistic approach through interaction with animals in nature.
Systematic Review in Action

- Focused clinical question

The objectives of this review were to summarize the evidence from randomized controlled trials (RCTs) on the effects of animal-assisted therapy (AAT). Studies were eligible if they were RCTs. Studies included one treatment group in which AAT was applied.

- Exhaustive search

1. **MEDLINE**
   - #1 Search ("Animal Assisted Therapy" [Mesh] OR Animal Assisted Therap)
   - #2 Search ("animals, domestic" [Mesh] OR domestic animal)
   - #3 Search ("bonding, human-pet" [Mesh] OR companion animal)
   - #4 Search (#1 OR #2) OR #3
   - #5 Search (Randomized Controlled Trial[pt] or Multicenter Study[pt] or Controlled Clinical Trial[pt] or Randomized Controlled)
   - #6 Search (#4 AND #5 Filters: Publication date from 1990/01/01; Humans; English; Japanese

2. **CINHAL**
   - #1 (MH "Animal Assisted Therapy (Iowa NIC")
   - #2 "animal assisted" AND therap
   - #3 MH "Pet Therapy"
   - #4 MH "Human-Pet Bonding"
   - #5 S1 OR S2 OR S3 OR S4

Systematic Review in Action

• Detailed inclusion criteria

  Types of studies
  Studies were eligible if they were RCTs.

  Types of participants
  There was no restriction on participants.

  Types of intervention and language
  Studies included at least one treatment group in which AAT was applied. The definition of AAT in this study was based on the classification of the AVMA. Type of animal was not a restriction but we excluded robotic animals (e.g., robotic dog). There was no restriction on the basis of language.

  Types of outcome measures
  We focused on all cure and rehabilitation effects using the International Classification of Diseases-10 (ICD-10).

• Independent review

  Selection of trials
  In order to make the final selection of studies for the review, all criteria were applied independently by four authors (e.g., TH, JK, SP, and SO) to the full text of articles that had passed the first eligibility screening (Fig. 1). Disagreements and uncertainties were resolved by discussion with other author (e.g., HK, KT, and YM).

Bias in Systematic Reviews

- Quality of studies
  - Publication bias (funnel plot)
  - Quality assessment
    - Cochrane
    - Ottawa-Newcastle scale
Systematic Review in Action

• Quality Assessment

We evaluated 11 items from the Cochrane’s criteria list in more detail (Table 4). Inter-rater reliability metrics for the quality assessment indicated substantial agreement for all 121 items (percentage agreement 97% and $k = 0.939$).

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria list</th>
<th>Reference no.</th>
<th>Present description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Was the method of randomization adequate?</td>
<td>? y y y y y y ? y n n y ? 7</td>
<td>64%</td>
</tr>
<tr>
<td>2</td>
<td>Was the treatment allocation concealed?</td>
<td>? n ? y y y y y ? n ? 5</td>
<td>45%</td>
</tr>
<tr>
<td>3</td>
<td>Were the groups similar at baseline regarding the most important prognostic indicators?</td>
<td>y y y y y y y y y y y y 11</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Was the patient blinded to the intervention?</td>
<td>? n ? y y y n n n n y 4</td>
<td>40%</td>
</tr>
<tr>
<td>5</td>
<td>Was the care provider blinded to the intervention?</td>
<td>? n n y ? ? y n n n y 3</td>
<td>27%</td>
</tr>
<tr>
<td>6</td>
<td>Was the outcome assessor blinded to the intervention?</td>
<td>? ? ? n ? n ? y y n y 3</td>
<td>27%</td>
</tr>
<tr>
<td>7</td>
<td>Were co-interventions avoided or similar?</td>
<td>y n y y y y y y y ? y y 8</td>
<td>73%</td>
</tr>
<tr>
<td>8</td>
<td>Was the compliance acceptable in all groups?</td>
<td>y y y y y y y y y y y y 10</td>
<td>91%</td>
</tr>
<tr>
<td>9</td>
<td>Was the drop-out rate described and acceptable?</td>
<td>y y y y y n n y y y y y 8</td>
<td>73%</td>
</tr>
<tr>
<td>10</td>
<td>Was the timing of the outcome assessment in all groups similar?</td>
<td>y y y y y y y y y y y y 11</td>
<td>100%</td>
</tr>
<tr>
<td>11</td>
<td>Did the analysis include an intention-to-treat analysis?</td>
<td>n n y y y n n n ? n y y 5</td>
<td>45%</td>
</tr>
</tbody>
</table>

Results of Systematic Review

Qualitative synthesis

• Study findings are systematically compared using a series of expert judgements

Quantitative synthesis

• Numerical data about effects of the treatment are pooled and analyzed together (meta-analysis)
Systematic Review in Action

• Qualitative synthesis

The most commonly reported target diseases were "Mental and behavioral disorders (F10-20, 30–33, and unclear)" and the effect of AAT on these diseases was improved mental health (e.g., anxiety and mood), QoL, and social behavior. The main reason given in these articles were "Diseases of the circulatory system (I00-I99)," "Injury, positioning, and certain other consequences of external causes (T00-T98)," "Psychiatric disorders involving communicative skills," and "Self-reported outcomes for hospitalized patients and other patients with various clinical conditions."

Although further accumulation of RCT data is necessary, AAT may be effective treatment for the following diseases and symptoms: cancer and/or advanced life-limiting illnesses that affect mental state and QoL, impaired circulatory function with mechanical assistance, autistic spectrum disorders involving communicative skills, and self-reported outcomes for hospitalized patients and other patients with various clinical conditions.

• Quantitative synthesis

Meta-analysis

There were three RCTs on schizophrenia and two RCTs on depression. We could not perform a meta-analysis because of heterogeneity by difference of outcome measurement and intervention method (e.g., in dog, and in dog or cat).
Meta-Analysis: Heterogeneity

How similar are the studies in a Systematic Review?

• Study Design
  • Participants
  • Interventions
• If similar enough, then meta-analysis is possible
• Outcomes
  • $I^2$ statistic (goal = 0%)
Advantages of Meta-Analysis

• Increases power (# of participants) and precision (estimate of true effect)
• Reduces problems with interpretation due to sampling variation
• Assesses among-study variation
• Allows for comparative effectiveness of multiple interventions
Meta-Analysis: Forest Plots

What is the outcome when all results are combined?

Overall effect (pooled)
Meta-Analysis: Forest Plots

What is the outcome when all results are combined?

<table>
<thead>
<tr>
<th>Study</th>
<th>No with recurrent headache</th>
<th>Relative risk (fixed) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (fixed) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innes 1999</td>
<td>9/49</td>
<td>14.97 (0.41 (0.21 to 0.80))</td>
<td>100.00</td>
<td>0.74 (0.60 to 0.90)</td>
</tr>
<tr>
<td>Jones 2003</td>
<td>8/34</td>
<td>6.61 (0.85 (0.38 to 1.89))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baden 2006</td>
<td>4/31</td>
<td>6.14 (0.39 (0.13 to 1.13))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donaldson 2006</td>
<td>21/57</td>
<td>14.10 (0.86 (0.53 to 1.40))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiessele 2006</td>
<td>19/44</td>
<td>14.09 (0.89 (0.56 to 1.40))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friedman 2007</td>
<td>39/106</td>
<td>30.26 (0.85 (0.61 to 1.19))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rowe 2007</td>
<td>14/64</td>
<td>13.83 (0.68 (0.38 to 1.22))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) = 385/353

Test for heterogeneity: $\chi^2 = 6.21$, df=6, P=0.40, $I^2 = 3.4%$
Test for overall effect: $z = 3.01$, P=0.003

Heterogeneity

Overall effect (pooled)

RR and CI for each study

Line of no effect

Scale of effect

Direction of effect
Sensitivity Analysis

- Sub-groups studies in the meta-analysis to see how pooled effect changes
  - Study quality
  - Publication status
  - Study type
- Little or no change = greater confidence in results
Fixed Effects vs Random Effects

What does the model say about the included studies?

• Fixed effects
  • Individual studies share a common, single effect
  • Variance due to sampling errors
    • Within study variation
  • Higher precision = higher weight
    • Precision estimated by study size
  • Narrow confidence interval for pooled effect
Fixed Effects vs Random Effects

What does the model say about the included studies?

• Random effects
  • Individual studies estimate a range of different effects that are similar enough to combine
  • More heterogeneity (populations, interventions)
  • Weight for studies based on:
    • Precision (within study variation)
    • Distance from the estimates in other studies (between study variation)
  • Wider confidence interval for pooled effect
Network Meta-Analysis

• Expands the scope of traditional meta-analysis
• Directly and indirectly compares multiple interventions based on a common comparator
Critical Appraisal assignments
- Havey et al. (2015)
- Bert et al. (2016)

Module 6 Quiz

Optional videos and readings

Schedule Evidence Table consultation