Homeopathy In Upper Respiratory Tract Infections? The Impact Of Plausibility Bias

Corresponding Author:
Dr. Lex Rutten,
MD, Dutch Association of Homeopathic Physicians (VHAN), Aard 10, 4813 NN - Netherlands

Submitting Author:
Dr. Lex Rutten,
MD, Dutch Association of Homeopathic Physicians (VHAN), Aard 10, 4813 NN - Netherlands

Article ID: WMC001126
Article Type: My opinion
Submitted on: 06-Nov-2010, 10:04:42 AM GMT Published on: 06-Nov-2010, 10:36:33 AM GMT
Article URL: http://www.webmedcentral.com/article_view/1126
Subject Categories: HOMEOPATHY
Keywords: Homeopathy, Plausibility, Bias, Antibiotics, Upper respiratory tract infections, Bayes theorem

How to cite the article: Rutten L, Lewith G, Mathie R, Fisher P. Homeopathy In Upper Respiratory Tract Infections? The Impact Of Plausibility Bias. WebmedCentral HOMEOPATHY 2010;1(11):WMC001126

Source(s) of Funding:
no funding source

Competing Interests:
no competing interests
Homeopathy In Upper Respiratory Tract Infections?
The Impact Of Plausibility Bias

Author(s): Rutten L, Lewith G, Mathie R, Fisher P

My opinion

A meta-analysis of a subset of eight ‘larger higher quality’ randomised controlled trials (RCTs), drawn from 110 matched RCTs each of homeopathy and conventional medicine, concluded that the results of the trials were consistent with the hypothesis that homeopathy is a placebo effect [1]. This meta-analysis was criticised for the heterogeneity of the trials on which its conclusion was based (all eight were for different conditions).

In an apparent paradox, the same meta-analysis concluded that homeopathy had a ‘substantial beneficial effect’ in acute upper respiratory tract infections (URTI), without evidence of positive bias. Other meta-analyses have reached similar conclusions [2, 3]. There is evidence from clinical studies of varying designs that homeopathy may be effective in treating acute otitis media [4-6]. Homeopathy is frequently prescribed for URTI by homeopathic GPs [7]. There is also some evidence from western Europe that general practitioners (GPs) with homeopathic training prescribe fewer antibiotics than their counterparts in conventional medicine [8-10].

The plausibility paradox

The problem with homeopathy for most doctors and scientists is the inherent implausibility of the idea that ultra-diluted solutions can have chemical effects [11]. Clearly it is highly unlikely that a medicine that does not contain a single molecule of the original substance could work like a conventional medicine. Sometimes the outcome of RCTs overturns theory, but at other times evidence is dismissed because of theory. Vandenbroucke states “Accepting that infinite dilutions work would subvert more than conventional medicine; it wrecks a whole edifice of chemistry and physics” [12].

An early systematic review of clinical trials stated, “we would accept that homeopathy can be efficacious, if its mechanism of action were more plausible” [13]. Contrary views have also been expressed: demanding more evidence may itself be considered unscientific; the same level of supporting clinical trial evidence should be acceptable for all scientific developments. If a lower level of proof is set for hypotheses that fit prior beliefs then we bias our view of science in favour of such beliefs and may be easily misled [14].

Does the fact that it is highly unlikely that many homeopathic medicines have a chemical effect really wreck a ‘whole edifice of chemistry and physics’? Chaplin mentions a number of possible mechanisms of action that are more likely than chemical effects, like water clustering and nanobubbles [14]. ‘Inherent implausibility’ is a poor guide to future understanding. History is littered with examples of ideas that at one time appeared highly implausible but are now accepted as fundamental truths: the Copernican revolution and quantum physics are well-known examples [15].

The possibility of other mechanisms, the opinions of users and prescribers, fundamental research and epidemiological evidence are all ignored because of the implausibility of a chemical effect of extremely high dilutions. Goodman used Bayes' theorem to illustrate that the usual proof is not sufficient for belief in efficacy [16]. Rosendaal and Bouter illustrated this by assigning one significantly positive RCT a likelihood ratio (LR) of 16 [17]. This LR is then entered into Bayes' formula:

\[
\text{Posterior odds} = LR \times \text{prior odds}#
\]

Their estimate of the prior that homeopathy ‘works’ was one in a million; implying that ‘works’ actually meant ‘works in an accepted pharmacological way’. Then they calculate using Bayes’ formula that the chance that homeopathy works goes from one in a million to less than one in ten thousand after one positive RCT.

The principal weakness of Bayesian statistics is the subjectivity in estimating the prior chance [18]. Priors are usually estimated by experts in the field. Should the prior for homeopathy be the chance that it has a chemical effect or the chance of other effects? In Bayesian reasoning all evidence should be used for sequential updating with the Bayes’ formula, and very low priors especially are particularly influenced by this updating [19]. If we suppose that the proof of one RCT has LR=16, sequential updating for eight positive trials proceeds as in table 1.

Illustration 1: Table 1

This example merely shows that evidence consisting of a considerable number of RCTs and a variety of other evidence cannot be dismissed by a simple Bayesian argument. A complete Bayesian discourse about proof is much more complex [20]. We see that 7
consecutive, positive, trials suffice to bring belief from one in a million to very nearly 100%, and that there is a ‘ceiling effect’: additional positive studies have very little impact. The 8 trials on homeopathy for URTI have certainly not had such an impact on beliefs in the medical community. This might be due to suspicion of bias based on the plausibility fallacy.

Sources of bias
Sterne et al assumed that quality bias accounted for the positive results of RCTs of homeopathy [21], but several authors have concluded that the quality of evidence for homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.

But there is incommensurability between the homeopathic and conventional data sets: for instance it excluded some larger homeopathy is not inferior to that for conventional medicine [12, 13]. Shang’s analysis was the first to make direct comparison of homeopathy trials with conventional trials. Plots of odds ratio versus the standard error of RCTs show a picture that is not consistent with a placebo effect and a similar pattern for homeopathy and conventional medicine (figure 1)[12]. There was no statistically significant difference in asymmetry.
medicines exert physiological effects?’. A clinical trial is a clumsy and expensive way of answering such a question, which would be much better answered by biological models. A number of such models have been described [38], and their further development might enable homeopathy to become framed in the plausible theoretical background that it requires.

# Odds = chance / (1 – chance); in words, the chance that something will happen divided by the chance that it will not happen. Odds = 1 means: chance is fifty-fifty.

LR = Likelihood ratio = True positives / False positives

Conclusion

We conclude therefore that a controlled clinical trial on homeopathy for otitis media (or other URTI) should be of pragmatic design and large-scale in nature. If viewed against a background of enhanced plausibility through new basic research, the results of such a trial might have far-reaching impact on the treatment of otitis media (URTI) and on the contribution of homeopathy in primary care practice.

Abbreviation(s)

RCT: randomised controlled trial
URTI: upper respiratory tract infections
LR: Likelihood Ratio

Reference(s)

Illustrations

Illustration 1

Table 1: Sequential updating of belief; the posterior chance from evidence No. 1 becomes the prior chance for evidence No. 2, etc.

<table>
<thead>
<tr>
<th>RCT number</th>
<th>Prior chance</th>
<th>Posterior chance</th>
<th>LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.000001</td>
<td>0.000016</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>0.000016</td>
<td>0.000256</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>0.000256</td>
<td>0.004079</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>0.004079</td>
<td>0.061505</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>0.061505</td>
<td>0.511856</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>0.511856</td>
<td>0.943748</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>0.943748</td>
<td>0.996289</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>0.996289</td>
<td>0.999767</td>
<td>16</td>
</tr>
</tbody>
</table>
Illustration 2

Figure 1: Plots of 110 homeopathy trials (top panel) and 110 conventional trials (lower panel, matched on medical indication. (source Shang; Lancet 2005; 366:726-732, with permission from Elsevier)
Disclaimer

This article has been downloaded from WebmedCentral. With our unique author driven post publication peer review, contents posted on this web portal do not undergo any prepublication peer or editorial review. It is completely the responsibility of the authors to ensure not only scientific and ethical standards of the manuscript but also its grammatical accuracy. Authors must ensure that they obtain all the necessary permissions before submitting any information that requires obtaining a consent or approval from a third party. Authors should also ensure not to submit any information which they do not have the copyright of or of which they have transferred the copyrights to a third party.

Contents on WebmedCentral are purely for biomedical researchers and scientists. They are not meant to cater to the needs of an individual patient. The web portal or any content(s) therein is neither designed to support, nor replace, the relationship that exists between a patient/site visitor and his/her physician. Your use of the WebmedCentral site and its contents is entirely at your own risk. We do not take any responsibility for any harm that you may suffer or inflict on a third person by following the contents of this website.