Chapter 13. Alternative medicine is no alternative

This chapter is from my book, *Gøtzsche PC. Survival in an overmedicated world: look up the evidence yourself. Copenhagen: People's Press; 2019*, which has been published in 7 languages; Danish, Dutch, English, German, Italian, Spanish, and Swedish.

When I give public lectures explaining how dangerous many of our drugs are, and how many lives they take, I am often asked: "What is the alternative?"

My reply is simple: The alternative to drugs is no drugs. We would have a healthier and more long-lived population if we took fewer drugs. Unfortunately, doctors and other health professionals, and even many patients, find it very difficult to do nothing, even though most of us know that a good surgeon knows when *not* to operate.

Quite often, we should let nature take its course because our bodies and minds have a great capacity for self-healing. In other cases, we might prefer a non-drug intervention that has documented effects, for instance, psychotherapy for mental health issues.

An entirely different matter is alternative medicine. It is very popular with patients and therefore also with the politicians elected by people who are often patients. In the United States, many billions of dollars have been used on research into alternative medicine, yet this huge investment has not been wise. The same is happening in my country. Political initiative set up a center to review and do research in this area. The center was closed down fifteen years later because nothing of substance had come out of this investment. We were told that various alternative treatments lacked scientific support - which we already knew - or received totally wrong messages such as that homeopathy works for children with ADHD. Homeopathy cannot work for anything - see below.

Many patients and some doctors are attracted by the irrationality of alternative medicine, which I assume is related to the propensity human beings have for religious beliefs. Alternative medicine is so popular that the editors of the textbook of internal medicine (also called general medicine), used by medical students in Denmark, decided a chapter was needed about it, even though allowing such an addition to be included in a fine textbook like that is very strange. They asked me to write it, not because I had demonstrated any interest in the subject, but because they knew I had the skills to go through the literature critically.

I looked for evidence of beneficial effects of the most commonly used treatments and came up empty-handed. None of the evidence I found was so convincing that I would recommend the treatments.[1] Furthermore, as I will explain in the following, alternative medicine is not harmless.

Also called complementary medicine, there is no commonly accepted definition of alternative medicine which might delineate a logical boundary to other treatments. Most definitions say it is not presently considered part of conventional medicine. That could be translated into: It does not work. If it worked, doctors would be happy to use it - and would not call it alternative. Like all definitions, that definition causes problems. Doctors use many treatments that do not work, such as antibiotics for viral infections. Conventional treatments also include many drugs approved by the authorities and marketed by drug companies for specific indications, even though they do not provide any benefits for patients. Yet we do call them drugs and not alternative medicine, nonetheless. Conversely, it very rarely turns out that an alternative remedy has a true effect, in which case it is no longer alternative in my view.

To a large extent, drug development builds on natural products. For example, the first

effective drug against cancer, paclitaxel (Taxol), was extracted from the bark of the Pacific yew tree, and quinine, the first effective drug against falciparum malaria used in Europe came from the bark of the South American cinchona tree. Malaria was introduced to the Americas by Europeans, and the Quechua peoples of Peru, Bolivia, and Ecuador discovered that a bark they already used for shivering of other causes, even worked for malaria. *Artemisia*, an extract from sagebrush, is also effective against falciparum malaria. That treatment has been used by the Chinese for over a thousand years, yet it needs to be stated that the Chinese have used many other herbal remedies, and this was the only one out of almost 200 which proved to be effective when it was scientifically investigated.

When I sit at a dinner table with people I have not met before, I try not to reveal that I am a doctor, because I have experienced that the conversation may then go astray and become quite strenuous. Sometimes I cannot escape listening to my tablemate's long, convoluted medical histories because they are seeking my opinion. Yet taking on the role of a doctor for strangers is usually a bad idea because I do not know the details of their medical histories. Sometimes people get very agitated when I gently tell them that I am *not* interested in discussing alternative medicine. It is like telling a religious fanatic that I do not believe in any gods and do not wish to discuss it.

Once my tablemate was immensely tenacious and just would not accept my excuse that I knew too little about Chinese herbs to say anything of value about them. I tried to start a conversation with someone else at the table, but the man would not let me go. There was no empathy whatsoever, let alone any modicum of politeness.

He ultimately played his trump card: "Don't you agree that Chinese herbs must be good for people, because the Chinese have used them for thousands of years?" I responded: "They also used bamboo as a building material for thousands of years. If I was an engineer, would you then have told me to use bamboo to build road bridges because the Chinese used it for thousands of years?" For the rest of the evening, he did not look my direction.

Herbal medicine is called natural medicine in some countries, and it is defined as medicinal products whose active ingredients are naturally occurring substances in concentrations not significantly greater than those in which they occur in nature. However, there is nothing 'natural' about natural medicine. In the evolutionary battle for survival, many plants have developed toxins that can be deadly for humans and other animals.

Practitioners of alternative medicine rarely have a medical education and therefore, the diagnoses they make should generally be disbelieved. Some of the diagnostic methods are really 'alternative.' It makes no sense to believe that a diagnosis can be made by looking people in the eyes (iris analysis), examining the patient's aura, recording the propagation of the vibrations from a tuning fork placed on the knee, or analyzing the mineral content in a person's hair – all used to diagnose a wide variety of health issues and as the basis for prescribing supplements.

One of the stereotypes in the criticism of authorized medicine is it is reductionistic, whereas alternative medicine is described as holistic. However, alternative medicine actually offers the greatest simplifications. A wide variety of diseases are reduced to having singular explanations. Imbalances in clients' energy systems or small vertebral misalignments called subluxations in their spines get the same treatments, such as rubbing the soles of their feet, physical manipulations, or a homeopathic remedy for headache, irrespective of whether it is caused by a brain tumor or influenza.

Some practitioners of alternative medicine have psychological insight and may help clients suffering from stress, undue perfectionism, low self-esteem, anxiety, sadness and depression, but that is due to human qualities. It has nothing to do with the use of alternative treatments.

Sometimes that is called the placebo effect, yet there is no generally accepted definition of what constitutes placebo and, in my view, the term should not be used for effective interventions.

Human interactions can be effective, but we call that psychotherapy because we are trying to influence people's psyches (or minds).

The explanations about causality that alternative therapists use to support their claims of positive effects are often speculative and have no connection with reality. In 1964, American magician James Randi promised a reward of one million dollars to anyone who, under agreed-upon, controlled circumstances, could prove pseudoscientific postulates, for instance, the alleged mechanism of action for the effects of reflexology, homeopathy, acupuncture and chiropractic healing (apart from the effects on back and joint pain). Over a thousand people have tried, yet all have failed, and the challenge was terminated in 2015.

About a quarter of all Danes contact an alternative practitioner every year,[1] and many more buy alternative products like supplements and herbal medicine in pharmacies and elsewhere. The most popular treatments are those involving bodily contact – which is easily understood from an evolutionary perspective. Apes and monkeys spend quite some time grooming each other which is important for the social cohesion and for maintaining the hierarchy, and we humans probably miss that kind of physical proximity. In addition, some alternative therapists are good listeners and they tell their customers how unique they are.

The most frequent reasons for seeking alternative treatment are mild symptoms or disorders, a desire for increased well-being or the prevention of diseases. A wish to be actively involved while avoiding medication harms also plays a role. Some people have realized their doctors cannot cure them and are desperate to try anything, making them vulnerable to exploitation by all sorts of quacks and fraudsters. Unfortunately, some of those practitioners who exploit people's fear of dying are doctors using quack remedies, such as large doses of vitamins for AIDS.

A term that has found its way to contemporary language is "the worried well," which implies that although you feel healthy and are in good shape, there could be some unknown issues in your body that you should get checked. That is a terribly bad idea. Alternative practitioners cannot make proper diagnoses and, if they do, they are highly likely to be speculative, wrong and lacking any scientific basis. People are often told that something is wrong with their energy systems; that they have a lack of certain minerals or vitamins; that they are being poisoned with all sorts of substances and therefore need special treatments like intestinal cleansing; or that they need peculiar diets.

Today, we know so much about the human body, and its physiology and pathophysiology, that alternative therapists cannot be excused for speaking mumbo jumbo to their clients. No "cleansing" is needed, because the liver and kidneys take care of toxic substances, and there is no good evidence that dental fillings with amalgam leads to health problems, or that some people suffer from multiple chemical sensitivities.

Alternative therapists often claim it is not possible to investigate the effects of alternative medicine in randomized trials. They say that research designs change the natural circumstances of treatment situations and, therefore, the results are unreliable because patients cannot benefit from the placebo effect. However, no good evidence exists to support this view. First, comparisons between patients who received a treatment in a randomized trial and patients who received the same treatment outside the trial did not show a poorer effect in the trials - the effects were similar.[2] Second, the placebo effect is greatly exaggerated. We did a Cochrane review of 234 trials where a placebo intervention was compared with an untreated control group, and we did not detect any clinically important effects of placebo interventions in general.[3] We found in certain

settings that placebo interventions can influence patient-reported outcomes, especially pain and nausea, but it is difficult to distinguish between patient-reported effects of placebo and biased reporting. An untreated control group cannot be blinded - the patients know they are not being treated and may be disappointed about that.

Another common misconception is believing that if you cannot blind a treatment, you cannot study it in a randomized trial. However, blinding and randomization are two different things, and patients can be randomized into two treatment groups which are then compared. In some cases, blinding is simply not possible, e.g. if the treatment is surgery, psychotherapy or reflexology. Yet in such cases, treatment effects can be evaluated by someone who is unaware of the treatments the patients received. Or we can use objective outcomes that are unlikely to be influenced by any lack of blinding, such as survival or return to work. Serious alternative therapists have long acknowledged that the potential effects of their remedies must be investigated in randomized trials. Accordingly, there are thousands of randomized trials of alternative treatments and many Cochrane reviews of the trials.

A common argument for using alternative medicine is that it cannot hurt. Apart from the fact that we treat people because we hope to help them, *not* because we hope we will not harm them, the argument is wrong for several more reasons.

First, fraud is very common. When patients attending a dermatology clinic in England who reported using herbal creams with good effect for atopic eczema were asked to submit those creams for analysis, it was found that 20 of 24 creams contained potent corticosteroids.[4] Locally applied corticosteroids surely work but have many irreversible harms, e.g. thinning of the skin and easy bruising.

Second, the ingredients can be toxic. If you read textbooks on alternative medicine, you will discover that some treatment ingredients are outright dangerous. Liver failure and deaths have occurred after ingestion of Chinese herbal tea containing wild germander.[5]

Third, patients are often exposed to curious regimens with strict injunctions about what to eat and drink, or they are treated with mineral mixtures or large doses of vitamins, even though such regimens can be dangerous. As already noted, a review of the placebo-controlled trials of antioxidants showed that beta-carotene and vitamin E increase mortality.[6] We need vitamins and essential minerals, e.g. zinc and copper, to make our enzymes work, but if we get too much, we might die. The human body is far more complicated than alternative practitioners would like us to think and it is well adapted to the environment.

Fourth, many alternative practitioners advise against vaccines even though there is no doubt that their beneficial effects far outweigh the harms. A 2002 survey showed that 31 of 77 homeopaths and 3 out of 16 chiropractors advised against giving one-year old infants a vaccination for measles, mumps, and rubella (MMR).[7] Since they knew they were participating in a research study, their advice in their daily practices might be even worse.

Alternative medicine fraud is not only about secretly and illegally adding substances with known pharmacological effects, listed ingredients may also be missing: In 2015, four US retailers were accused of selling fraudulent dietary supplements that were, in many cases, contaminated with unlisted ingredients.[8] Authorities had run tests on popular store-brands of herbal supplements at Walmart, Walgreens, Target and GNC and found that approximately four out of five of the products contained none of the herbs listed on their labels. In many cases, the supplements contained little more than cheap fillers like rice and house plants, or substances that could be hazardous to people with food allergies. In pills labelled ginkgo biloba, the agency found

only rice, asparagus and spruce, an ornamental plant commonly used for Christmas decorations. At Target, the agency tested six herbal products, of which three - including ginkgo biloba, St. John's wort and valerian root - tested negative for the herbs listed on their labels. The pills contained powdered rice, beans, peas and wild carrots.

Manipulation of the spine

Several professions offer manipulations of the spinal column: doctors, chiropractors, physiotherapists and alternative therapists.

Chiropractic treatment was founded in 1895 by Daniel Palmer, an American magnetic healer. It was assumed that all diseases were caused by small displacements (subluxations) in the spinal column.

Chiropractors and like-minded people often take X-rays of spines and then declare that they can see what is wrong, typically minor subluxations. Such statements should be disbelieved. Many scientific studies have been carried out comparing X-ray films with clinical symptoms, and the correlation between the two is close to zero. That poor correlation is also found elsewhere in the skeleton. X-rays of the hip or knee joints can look terrible, with almost no cartilage, in patients without pain, whereas other patients, who have very little visible damage to their joints, may suffer a great deal from osteoarthritis pain. Of course, there are exceptions to this general rule, one of which is osteoporosis with compression fractures in the spine, but that is not a condition which is treatable with manual therapy.

Many randomized trials have been carried out, but since the effect measures are subjective, the fact that these trials cannot be blinded is a major problem. Detected modest effects on pain could be due to reporting bias, because both therapists and patients want to believe that manipulation works. Spinal manipulative therapy is widely practiced, but a Cochrane review of 20 trials that had studied acute low back pain did not find any effects.[9] Manipulation was no more effective than sham manipulation, inert interventions or when it was combined with another intervention, and it also appeared to be no better than other recommended therapies.

The effect of spinal manipulative therapy on chronic low back pain is similarly disappointing. A Cochrane review of 26 trials found small, statistically significant but clinically irrelevant, short-term effects on pain relief and functional status compared to other interventions.[10] Data were particularly sparse for recovery, return-to-work, quality of life, and costs of care. The effect on functional status was measured by a variety of scores based on many individual components and a small improvement in such a score doesn't tell us whether the patients have actually been helped, only that it is not very likely.

A third Cochrane review of 51 trials studied manipulation and mobilization in treating neck pain.[11] The results for cervical manipulation and mobilization were few and diverse. The authors found some support for use of thoracic manipulation for neck pain, function and quality of life, but warned that publication bias could not be ruled out and that research designed to protect against various biases was needed. More than half of the trials did not report on harms but in rare cases, manipulation can result in stroke, disc herniation or serious neurological deficits. Manipulation of the neck can lead to permanent paralysis of arms and legs (tetraplegia). According to a verdict in a Danish court of law in relation to a case of paralysis, the duty to inform about possible harms is particularly strong when the patients are basically healthy before treatment, even if the potential harmful effects are extremely rare. I doubt that patients are properly informed before neck manipulation is carried out. Who would want to run a risk of becoming tetraplegic?

The harms of manipulation are probably very underreported. In 2012, US doctors described a nurse with chronic neck pain who had seen the same chiropractor for over ten years, usually going once a month for cervical spine manipulation.[12] As the manipulations so clearly did not help her, she should have dropped the chiropractor, but because of a new symptom - pain when turning her head up and to the right - her current visit was the fourth in a week. During the manipulation, when the patient's head was turned rapidly, she heard a loud pop and immediately felt the room spinning. Over the next few minutes, the vertigo intensified, and she began sweating profusely. She also noted a blind spot in her left eye, along with other visual field disturbances. These doctors also described a prospective series conducted over four years at a single institution that reported 13 patients with cervical dissection related to chiropractic manipulation. Twelve patients presented with acute neurologic symptoms, three were permanently disabled, and one died.

Other deaths have occurred after the patients received chiropractic therapy, and many hundreds of serious complications have been described in the research literature.[13]

I once saw cervical manipulation being performed by a specialist in rheumatology and I was absolutely horrified. The doctor stood behind the patient and had placed the palms of his hands on each side of the face. Suddenly, without warning, he turned the patient's head rapidly to the right. In my view, it should be illegal to perform this procedure and patients should not accept it.

People seem to love manual therapies. In the course of a year, about one-fifth of all Danes had manual therapy or massage at least once.[1] Whenever I have a musculoskeletal problem on the tennis court, be it a tennis elbow, a sprain, acute low back pain or knee pain, I get the same advice from my fellow players: "You should see a chiropractor." Even when I tell them I was a rheumatologist for 18 months and know what I am talking about, they keep insisting I should see a chiropractor. The only thing that works for a tennis elbow is rest. It takes time to heal and, in the meantime, you can swing your racket like a golfer - using your body instead of your arm - which lessens the strain on your elbow considerably. It might even improve your game.

One of my tennis partners is a rheumatologist and he once insisted on manipulating my lumbar spine when I had acute low back pain. I laid down on my stomach on the bench in the dressing room and he gave my back a quick slap with the palm of his hand. For the first few seconds it felt a bit strange and I could understand why some patients report positive effects. But after a few more seconds, my low back pain was the same. Manipulation seems to be about diverting attention from the pain - I could not help thinking that a blow to the head or a kick in the backside might have the same effect.

Manual treatment of colic and sleep problems in infants is even more alternative, and it is not surprising that the few trials that have been performed have been unconvincing. There is no rationale at all for suggesting that colic and sleep problems should be caused by subluxations, or that manual treatment of hay fever and asthma could be effective. Nonetheless, many chiropractors offer such meaningless treatments. There is a Cochrane review of the effects on asthma, which included three trials - there was no effect.[14] The authors concluded that there is a need to conduct adequately-sized trials that examine the effects of manual therapies on clinically relevant outcomes. No, there is no need. We should not waste our energy and resources on meaningless trials. Should a trial show an effect on asthma one day, it would most likely be fraud or a false positive finding. When a treatment that does not work is examined in a randomized trial, there is a 2.5% chance that the result will favor the treatment significantly.

Massage

Many Cochrane reviews of massage have been made, but the trials are small and of questionable quality.

Antenatal perineal massage for reducing perineal trauma during childbirth performed by the pregnant woman from week 35 reduced the incidence of episiotomy by 16% at first birth.[15] However, as the authors of the review mentioned, that effect had very little to do with the massage. These women were probably more motivated to avoid episiotomy than women in the control group, because that was the expected outcome of their efforts. The massage can be uncomfortable, unpleasant and even produce a painful or burning sensation. It is also possible to reduce the incidence of episiotomy by training the staff.

Massage for promoting mental and physical health in infants has been studied in 34 trials, but the results do not support the use of massage.[16] The trials are of poor quality and many of them do not address the biological plausibility of the outcomes being measured, or the mechanisms by which change might be achieved.

A review of 15 trials of massage for mechanical neck disorders graded the trials low or very low with respect to methodology, and no recommendations for practice could be made.[17]

Another Cochrane review of 25 trials reported on the effects of massage on low back pain and functional outcomes.[18] Large effects were reported but only in the short-term follow-up, and the outcome assessors had not been blinded. Thus, the authors had very little confidence that massage works for low back pain. I agree. Sometimes we believe in treatment effects even if we don't know the mechanism of action, but in such cases, the trials need to be of high quality and provide rather consistent results from trial to trial. When this is not the case and the outcome assessors have not been blinded and furthermore, when it appears unlikely that an intervention could work, we should be very skeptical. I cannot see any rationale for using massage for low back pain.

A Cochrane review of deep friction massage of tendinitis included only two small trials and did not find positive effects.[19]

The only thing that is certain about massage is that it hurts. And yet we are supposed to be grateful. Healthcare can be very strange at times. Massage of sore trigger points is very common, yet there are no indications that this painful treatment helps.

Reflexology

Reflexology has roots in traditional Chinese medicine and is based on the idea that massage of special zones on the soles of the feet can bring healing to sick organs. However, no one has demonstrated the existence of topographic links between the soles of the foot and the internal organs, or from hands or ears, which are also sometimes massaged. Few trials have been carried out and they are small and biased. There is no proven effect of reflexology on disease and it would not be expected. Reflexology has to do with well-being, not with curing or alleviating disease.

Acupuncture

Over a thousand randomized trials of acupuncture have been carried out, but the vast majority are of very poor quality. Trials performed in China have more positive results than other trials, and an overview of 49 Chinese trials in stroke showed that the more patients in the trial, the smaller the

effect.[20] The bias was extreme and very rarely is this well-known bias as pronounced as it is for acupuncture. Another review of acupuncture trials published in Chinese journals found that 99.8% of 840 trials reported positive results for the primary outccomes.[21]

One of the authors of the stroke overview[20] quizzed Chinese colleagues why the results were always positive. The uniform answer he received was that it would be very offensive for Chinese researchers to conceive a study which does not confirm the views held by their peers.[22] In other words, acupuncture research in China is conducted to confirm prior assumptions that acupuncture is effective. His conclusion was that acupuncture trials from China – which constitute most of the trials - cannot be trusted and should be discarded outright.

In addition, the vast majority of those trials employing placebo acupuncture as a control were not blinded. Reporting bias would be expected in nonblinded trials with subjective outcomes, which means that positive effects should be interpreted with great caution, even when the trials are not performed in China. We are in the same kind of landscape as for the trials of manual therapy discussed above.

By 2017, not less than 47 Cochrane reviews had the word ‘acupuncture’ in the title, and they are really colorful. Many of the reviews are about diseases for which we would not expect needle pricks to have any effect, e.g. schizophrenia, artificial insemination, induction of labor, autism, myopia, glaucoma, depression, insomnia, ADHD, stroke, epilepsy, traumatic brain injury, ischemic encephalopathy in neonates, stress urinary incontinence, menopausal hot flushes, uterine fibroids, asthma, mumps, cocaine abuse, Bell's paresis, vascular dementia, smoking cessation, restless legs and irritable bowel syndrome. Considering the poor quality of the trials, a high likelihood exists that the positive findings are fraudulent or false positives. On this background, it is remarkable that very few positive effects were reported for any of these diseases. I don’t find it worthwhile to comment on the individual reviews.

In 2009, we published a systematic review of three-armed trials which had an acupuncture group, a placebo acupuncture group, and a group that received no treatment.[23] We included 13 trials and 3025 patients with a variety of pain conditions. Surprisingly - and inexcusably - the clinicians managing the acupuncture and placebo acupuncture treatments were not blinded in any of the trials. We found a tiny difference between acupuncture and placebo acupuncture that corresponded to 4 mm on a 100 mm visual analogue scale, which is clinically irrelevant. The difference was larger between placebo acupuncture and no acupuncture, but the results were heterogeneous and the patients in the no-acupuncture group knew they were not being treated and therefore, might have reported the outcome in a biased manner. We found that it was unclear whether needling at acupuncture points, or at any site, reduces pain independently of the psychological impact of the treatment ritual. Our results strongly suggested that the theoretical basis for the existence of specific acupuncture points along the so-called meridians is incorrect.

I cannot see any clothes on this emperor. Yet it is easy to be fooled. "I was once invited to a conference in Florence. I wanted very much to see the famous Uffizi with the Renaissance paintings, but unfortunately, I had acquired a fierce pain in my back. At a dinner for the invited speakers, I happened to sit next to an acupuncturist who was kind enough to offer me a free treatment. The next day the pain in my back was gone and I could visit the Uffizi without any problems. What makes the story interesting is that I declined the acupuncturist's offer. If I had accepted, I would probably have had a more positive impression of acupuncture today."[24]

Acupuncture can be dangerous. During just one year, Danish authorities learned about four cases, including two children, where the needles had punctured the lungs, and one of the patients died.[25]

Healing, with or without the help of gods

There once was a Cochrane review of healing - therapeutic touch - where the therapist enters a meditative state and passes her hands above the patient's body to find and correct any imbalances in the patients' 'life energy' or 'chi.' Scientific measurements have been unable to detect this 'energy,' and the review found contradictory results of therapeutic touch on wound healing. There were four trials, all with the same first author, DP Wirth, and the review was withdrawn when it was pointed out that Wirth had committed fraud.[26] It is doubtful whether the trials were ever conducted since an investigation could not confirm the participation and identity of any study subjects or the trained practitioners and could not prove the existence of any raw data records. Furthermore, Wirth was actively perpetrating fraud, deception, identity theft, and other crimes for which he served prison sentences, all of which predated graduate school and continued through and beyond the time of his articles.

Several Cochrane reviews of the effects of touch are available. The underlying concept is that sickness and disease arise from imbalances in a so-called vital energy field. The effect of touch is believed to occur by exerting energy to restore, energize and balance energy field disturbances using hands-on or hands-off techniques.[27]

A Cochrane review reported some effect on pain but the review was withdrawn, officially because it was outdated,[27] yet that might have to do with inadequate methods. Blinding of the outcome assessor is crucial when pain is the outcome – but the review included trials that were not blinded and did not address this issue.

Other Cochrane reviews did not find support for the idea that touch could have an effect on anxiety or depression.[28,29]

<u>Intercessory prayer</u>

Distant healing includes prayer, and there is a Cochrane review of intercessory prayer.[30] Alternative medicine has much in common with religion: It is full of dogma, and pseudoscientific and supernatural thinking, and that dogma does not change throughout the centuries, no matter how much scientific evidence is presented disproving the dogma, e.g. homeopathic dilutions are still the same as those used over 200 years ago.

One would therefore expect a Cochrane review of intercessory prayer to be rather amusing - either on purpose, or unintentionally - and indeed it is. The review goes beyond what science and reason can justify and uses an unsound mixture of theological and scientific arguments.[31] There are ten randomized trials in the review aimed at testing the religious belief that praying to a god can help those being prayed for. From a scientific perspective, the *a priori* likelihood that prayer could be effective is extremely small because it involves three assumptions that are all highly unlikely to be true. First, the existence of a god; second, that prayer can somehow travel in space and reach this god, or that it works through another mechanism unknown to science; third, that this god is responsive to prayer and can influence - from a distance - what would otherwise have happened. Most researchers would find it futile to perform randomized trials of the effect of

prayer on those prayed for. Any observed effect would more likely be due to the play of chance, bias or fraud than to divine intervention. It would be more fruitful to study possible psychologically soothing effects among the prayers themselves.

The authors of the Cochrane review apparently did not discover that a suspicion of fraud had been raised against a large trial included in their review, and that the largest 'trial' was meant to amuse rather than present scientific evidence.

The authors say that, "outcomes of trials of prayer cannot be interpreted as 'proof/disproof' of God's response to those praying," and that what they attempt to quantify is an "effect of prayer not dependent on divine intervention." It is difficult to understand what they mean by this. Why would people pray to a god if an effect of prayer is not caused by divine intervention, and what would then be the causal mechanism? The authors provide no explanation, and it is hard to imagine how prayer for ill people located at the other side of the globe,[30] and who were unaware that someone prayed for them, could have an effect without assuming divine intervention.

It is also hard to accept that a god would help Peter in bed A, because someone, after randomization, was asked to pray for him, but not the less fortunate Paul in bed B. The authors contradict themselves when they say that their review focuses on people, "setting time aside to communicate with God," as the review is not about divine intervention. They are also inconsistent when they note that, "If understanding of God is as limited as the Holy Literature suggests (1 Corinthians 13:12), the consequences of divine intervention may be considerably more subtle than could be measured in the crude results of a trial." If that was a real concern, the authors should not have undertaken the review, because their reservation means that people who do trials of prayer cannot rely on what they observe.

Arguments like these are often used by practitioners of alternative medicine. They say that the research setup somehow makes it impossible to see or study the real effect of their treatments. In the theory of science, this approach is called immunization of the research hypothesis. It means that, regardless of the experimental results obtained, believers will be unaffected and will continue claiming with equal conviction that their treatments are effective.

Another statement also belongs to the realm of mysticism. The authors write that, "An omnipotent God would make concealment of allocation (of the participants to prayer or no prayer) impossible and may be noncompliant with the limitations of a randomized trial (Psalm 106:14,15, Job 42:2)." Since such a god could interfere with the experimental setup, it is difficult to understand why the authors excluded trials in which the treatment allocation was not concealed, and why they bothered to discuss the level of concealment in the trials they included.

The largest trial was published in *BMJ's* Christmas issue and was meant to amuse, in line with the tradition of this special issue, because the trial evaluated the effect of prayer taking place 4-10 years *after* the patients had either left the hospital alive or had died from their bloodstream infection. Thus, the trial evaluated the effect of *retroactive* intercessory prayer using historical data and its author argued that we cannot assume, "that God is limited by a linear time." The authors of the Cochrane review did not mention anywhere that the patients were randomized many years after their outcomes had occurred and did not discuss the likelihood that time can go backwards, and that prayer can wake the dead.

The author of the retrospective prayer study subsequently noted that "if the pre-trial probability is infinitesimally low, the results of the trial will not really change it, and the trial should not be performed. This, to my mind, turns the article into a non-study."[32] The non-study

'found' a nonsignificant reduction in death for those prayed for (relative risk 0.93, 95% confidence interval 0.84 to 1.03), but since it carried 75% of the weight in the meta-analysis in the Cochrane review, it led to a statistically significant effect of prayer.

Two years later, also in the Christmas issue, people with an interest in alternative medicine, prayer and healing tried to explain why the results of the retroactive study could be true using arguments from quantum theory.[33] They seemed to take their own arguments seriously, even though they were total nonsense which a physicist demonstrated a year later - again in the Christmas issue.[34] Down-to-earth, it should not be too difficult to realize that prayer cannot make dead patients come to life again. Furthermore, all the randomization did was to divide both the living and the dead into two groups that were then compared statistically. That is also meaningless because we already knew that any differences between the two groups were random.

The amusements and surprises did not stop there. Another trial originally had three authors, but the senior author subsequently withdrew his authorship. On PubMed, there is reference to an erratum in the journal,[35] but our university library has informed us that the page that should describe the withdrawn authorship does not exist in the journal. Therefore, we asked the editors of the *Journal of Reproductive Medicine* whether the PubMed citation is wrong or whether the erratum was not published in the Journal. We did not receive any reply despite repeated requests but were not the only ones who were ignored. Clarifications addressed to the authors and editors from scientists and journalists were not answered either, and not a single critical letter was published in the journal.[36,37] The trial was carried out at Columbia University in New York City and a news release from the university stated that the senior author led the trial. However, the vice president noted that the senior author first learned of the trial from the first author six to twelve months after it was completed.[36] One of the two remaining authors, lawyer Daniel Wirth (mentioned above), was sent to prison after 20 years of continuous criminal, fraudulent activities,[36,37] and the other author provided incorrect and misleading statements about the research[38,39] after being challenged by the editor to provide explanations when the scandal broke loose three years after the trial was published.

Wirth organized the study which reported a significantly higher pregnancy rate in the prayer group (50% versus 26%, P = 0.001) after in-vitro fertilization at a Korean hospital. The prayer was long-distance - carried out in USA, Canada and Australia. Those who prayed were Christians, as opposed to the Korean patients. Another curiosity is that the Catholic Church condemns in-vitro fertilization. Therefore, it would have been equally reasonable to conclude that the responsive god was not very well represented by the Pope as to conclude that one should pray for those seeking in-vitro fertilization.

Scientific misconduct seems to have been involved in a third trial[34,40] which was originally included in the Cochrane review, yet is now excluded, not because of suspected misconduct but because the intervention was distance healing and not prayer.

The authors of the Cochrane review also contributed further to the amusements, albeit not deliberately so. They included a study reporting an increased risk of surgical complications due to prayer but only if the patients were aware that people prayed for them. Instead of discussing the plausibility of this finding, the authors concluded that people intervening with prayer should be "cautious about informing the recipient," when it comes to surgery, and that managers and policymakers may wish to exercise some caution about "praying at the bedside of those who are about to have a surgical operation."

When discussing the effect of prayer on the "clinical state," the Cochrane authors argue that the lack of effect might be because the participants only received prayer for 14 days. Their inclination to theological reasoning leads to a tautology: "A caring God may not wish to prolong

suffering, so death therefore might be a positive outcome of prayer." This is a perfect immunization of the hypothesis that makes trials of prayer meaningless. If people survive, it is good for them, and if they die, it is also good for them. The authors' reasoning is based on the assumption of an omnipotent and all-knowing god. But if that were true? Why should we then try to influence our fate when such a god already knows what is best for us?

It is also amusing that the review is published in the Cochrane Schizophrenia Group, as it is characterized by delusional thinking. We informed the editor of the group about the major problems and he suggested we published a comment alongside the review, which we did. He also assured us that the review wasn't a joke, which we had hoped it was.

The review was updated in 2009 after our criticism of it and the authors have changed their conclusion. They originally wrote that, "The evidence presented so far is interesting enough to justify further study into the human aspects of the effects of prayer." But now they write: "We are not convinced that further trials of this intervention should be undertaken and would prefer to see any resources available for such a trial used to investigate other questions in health care."

However, they still include the study of retroactive prayer, justifying it with the most mysterious arguments. They call it a "relevant study," "not in jest," but "a rather serious paper." They say further that, "retrospective prayer is practised by some people," and that the study was double blind since those praying did not know the outcome for any of the patients. Well, perhaps they did not, but as the outcome was already known for all patients, it is wrong to give a study like this bonus points for being "double blind." The authors of the Cochrane view perverted the research methodological principles without even being aware that they had made themselves laughable.

On the possibility of waking the dead through prayer, they say: "Retrospective prayer may be considered theologically controversial, but we are not concerned with theology. Our aim is to review the empirical evidence for the efficacy of prayer as a treatment for ill-health rather than to consider questions of metaphysics. We judge ourselves bound to analyse the results of any trial that fits our original criteria (including our initial definition of prayer) and which is methodologically well constructed. Having set our protocol we are convinced that it would be unscientific to modify it to exclude a study that fits our criteria for inclusion."

This is dogmatic cook-book 'science' in its worst form. People are obliged to think even with a protocol. Otherwise, it is not science.

The review authors claim they have found no evidence that the study was a jest. That is not correct. The author of the retroactive prayer study explained that it was a jest,[32] and we pointed out in our comments on the review that we got the same answer when we wrote to the author.

Finally, the review authors say that, "We are keen that all studies meeting the clearly stated inclusion criteria should be reported (even if later stated to have been "written in jest"), rather than being kept hidden and perpetuating publication bias." That argument is nonsense. They could formally include the jest according to their inclusion criteria, but review authors are free to not include unreliable studies in their meta-analyses; in fact, this is recommended for Cochrane reviews.

It is a scandal for the Cochrane Collaboration that this ridiculous review has not been withdrawn a long time ago.

Craniosacral therapy

A craniosacral therapist website describes that treatment is based on a rhythm, the so-called 'craniosacral pulse,' which can be felt throughout the body. However, such a pulse has never been found in studies of human physiology.

Light touches are thought to relieve tension and blockages, especially around the head (the skull and its sutures), spine and pelvis. By searching the Cochrane Library on *craniosacral*, I found only one review.[41] It is about interventions for preventing and treating low-back and pelvic pain during pregnancy, and it includes one trial. There were 123 patients in the analyses and the therapy improved pelvic pain in the morning and functional disability (P = 0.02 for both outcomes). However, this result is very uncertain because the patients were not blinded. The authors described this trial as being at low risk of bias because there was an independent observer who measured the pain without knowledge of group assignment. But that is wrong. Pain is a subjective feeling that can only be assessed by the patient - and the patients were not blinded. Furthermore, the difference in morning pain was only 8 mm on a 100 mm pain scale, which is lacking clinical relevance and can easily be nothing more than bias in a nonblinded trial. The effect on functional disability was also small, and there were no significant differences between groups in evening pain or days off work/sick leave.

Homeopathy

Homeopathy was created by Samuel Hahnemann, a German physician who, more than 200 years ago, ceased to work as a medical practitioner because he realized that many treatments of his time were harmful. He noted that quinine induces the same symptoms as malaria and drew the wrong conclusion that patients should be treated with medications which, in healthy people, produce the same symptoms as the disease. He 'solved' the problem with the toxicity of quinine by diluting the solution a great number of times.

Hahnemann's doctrine "like-cures-like"- rooted in medieval medicine - is primitive and incorrect. He might be excused because medicine was dominated by all sorts of pseudoscientific theories, and no attempts were made to test these theories empirically.[42] As late as the first half of the 1800's, many physicians still accepted the ancient doctrines of humoral pathology, according to which disease represents an imbalance of the four humors (yellow and black biles, blood and phlegm). Other equally speculative systems of thought also reached considerable popularity.

A second doctrine of homeopathy is even more peculiar than the first one. It is held that infinitesimally small doses must be used, meaning that the preparation may be diluted so much that the patient does not ingest a single molecule. Present-day homeopaths are aware of this, yet still believe that preparations leave some sort of imprint in the solvent[43] - in other words, they claim that water can 'remember' what it once contained.

It is easy to work out what these dilutions lead to.[44] Hahnemann created the centesimal or "C scale," diluting a substance by a factor of 100 at each stage. A 2C dilution requires a substance to be diluted to one part in one hundred, and then some of that is diluted by the same amount. That works out to one part of the original substance in 10,000 parts of the solution. A 12C dilution means that the original material is diluted by a factor of 10^{12}. Already at this stage, the dilution is at a level that, starting with a substance contained in a small 1 cl syringe, it corresponds to dissolving that substance in the all the world's oceanic water. And then we are not even half-way through this because Hahnemann advocated 30C dilutions for most purposes, i.e. a dilution by a factor of 10^{60}. If we do that, it corresponds to dissolving the substance in a cube of water with sides far larger than the distance from the Earth to the nearest galaxy, the Andromeda Galaxy 2.5 million light years away.

For homeopaths, that is not a problem. A solution that is more diluted than another is described as having a higher potency, and homeopaths consider more diluted substances to be stronger and deeper-acting.

Healthcare cannot be more absurd than this. Doing randomized trials of homeopathy is equally unreasonable as trials of intercessory prayer. The purpose of such trials would be to find out whether homeopathy is more effective than placebo homeopathy, but we already know that this cannot be the case since homeopathy *is* a placebo. We would be comparing nothing with nothing, which is a futile exercise. Nevertheless, many randomized trials have been carried out and a meta-analysis of 89 trials was published in *The Lancet* in 1997 which reported a large effect, an odds ratio of 2.45 (95% CI 2.05 to 2.93) in favor of homeopathy.[45] The authors concluded that, "The results of our meta-analysis are not compatible with the hypothesis that the clinical effects of homeopathy are completely due to placebo."

Four years later, another group of researchers looked at the same 89 trials and found very different results.[46] When the results were depicted graphically, they were highly asymmetrical. The treatment effects were much larger in small studies and in studies with inadequate blinding of outcome assessment, and they were also larger in trials published in languages other than English. There was no effect in the largest trials of homeopathy, which were double-blind and had adequate concealment of the randomization (i.e. it was not possible to cheat by deliberately assigning patients with good prognoses to homeopathy and others to placebo homeopathy).

Fraud is common in alternative medicine and investigators might have added an active drug to the homeopathic solvent to make sure it worked, or they could have tampered with the results - or simply made them up. An instrument should be used for what it was designed for and we do randomized trials when we have genuine doubts about whether treatments work. We have no such doubts when it comes to homeopathy and therefore, we should not do trials or reviews of homeopathy.

A homeopathic pharmacopoeia has been prepared and in 2006, the UK Medicines Agency allowed manufacturers of homeopathic products to state what indications their products have, even though there were no requirements to demonstrate effects in randomized trials. Homeopathic remedies were offered through the National Health Service despite vocal protests from doctors, but the Minister of Health declared that the effect could not be demonstrated in ways required for conventional medicine. Prince Charles is an outspoken advocate for homeopathy and he likely played a role. It is difficult to earn a knighthood if you go against royalty.

The European Union also contributed to the folly in the most remarkable way. In 2011, the European Parliament's agriculture committee agreed to spend two million Euros on investigating whether cattle, sheep and pigs could benefit from homeopathy.[47] Critics pointed out that animals cannot benefit from a placebo effect because they will not understand they have been given a treatment.

That raises an interesting issue: Every time homeopathy is prescribed, a patient is deceived - which is unethical. There is another reason why homeopathy is unethical: The practice of homeopathy leads to serious harms. Since homeopathy is licensed in some countries for the treatment of specific symptoms, that might encourage the patients to delay seeing a doctor and serious conditions might be overlooked. Furthermore, when homeopathic remedies are seen as alternatives to proven treatments, patients might be putting their lives at risk.

There are reports of homeopaths convincing their customers not to take malaria prophylaxis when traveling in infested areas. In 2006, the BBC visited Britain's biggest manufacturer of homeopathic remedies with a hidden camera.[48] The journalist said she planned to go to Malawi – a high risk area – yet the shop only suggested garlic, oil of citronella and vitamins rather than a trip to the doctor. That was all they recommended for malaria. The adviser also told the journalist that the homeopathic compounds would protect her: "They make it so your energy

doesn't have a malaria-shaped hole in it so the malarial mosquitos won't come along and fill that in." Sheer gobbledygook, yet not atypical of the way many practitioners of alternative medicine 'explain' things.

The BBC also revealed that some homeopathic pharmacies claimed their products could treat malaria in lieu of anti-malarial drugs.[49] Homeopathic pharmacy websites show many products with indications, e.g. for influenza, and there are homeopathic replacements for vaccines against measles, mumps and rubella, and homeopathic pills for hepatitis, tuberculosis and typhoid.[49]

Sometimes it is the other way around - homeopathic remedies can contain too much of a substance. In the United States, several babies died probably because the biggest manufacturer of homeopathic remedies put too much of the deadly nightshade, *Atropa belladonna*, in its "teething" tablets.[50]

In 2017, a seven-year old Italian boy died from an ear infection that had spread to his brain.[51] The family's homeopath - who played doctor - discouraged the mother from giving the child antibiotics even though his condition worsened over a couple of weeks, and the homeopath noted that the homeopathic treatment should continue. In contrast, a doctor on call advised that the child should immediately go to hospital. Even when the infection spread and the boy was in critical condition, the family refused to give him antibiotics. When his parents finally called for an ambulance, it was too late. The boy went into coma and died three days later. The parents have been charged with manslaughter.

Homeopathy has never been popular in the Nordic countries. In 2003, only 1% of Danes took a homeopathic remedy,[52] whereas in France, 36% took such a remedy in 1992.[53] In the UK, homeopathic hospitals are functioning within the National Health Service, and in several European countries, homeopathy can be studied at universities.[53] In 1998, homeopathy was the most frequently used alternative therapy in 5 out of 14 surveyed countries in Europe, and in Germany, approximately 6,000 medical doctors had formal qualifications in homeopathy.[53]

There is little we can do to combat such overwhelming stupidity other than avoiding using homeopathy - or other alternative medicines - on ourselves and our loved ones.

1 Gøtzsche PC. Alternativ behandling. I: Ove B, de Muckadell S, Haunsø S, Vilstrup H, red., Medicinsk Kompendium. 18 udg. København: Nyt Nordisk Forlag Arnold Busck 2013;2789-98.

2 Vist GE, Bryant D, Somerville L, et al. Outcomes of patients who participate in randomized controlled trials compared to similar patients receiving similar interventions who do not participate. Cochrane Database Syst Rev 2008;3:MR000009.

3 Hróbjartsson A, Gøtzsche PC. Placebo interventions for all clinical conditions. Cochrane Database Syst Rev 2010;1:CD003974.

4 Ramsay HM, Goddard W, Gill S, et al. Herbal creams used for atopic eczema in Birmingham, UK illegally contain potent corticosteroids. Arch Dis Child 2003;88:1056-7.

5 Mostefa-Kara N, Pauwels A, Pines E, et al. Fatal hepatitis after herbal tea. Lancet 1992;340:674.

6 Bjelakovic G, Nikolova D, Gluud LL, et al. Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases. Cochrane Database Syst Rev 2012;3:CD007176.

7 Schmidt K, Ernst E. Survey shows that some homoeopaths and chiropractors advise against MMR. BMJ 2002;325:597.

8 O'Connor A. Alternative medicine: What's in those supplements? New York Times 2015; 3 Feb.

9 Rubinstein SM, Terwee CB, Assendelft WJJ, et al. Spinal manipulative therapy for acute low-back pain. Cochrane Database Syst Rev 2012;9:CD008880.

10 Rubinstein SM, van Middelkoop M, Assendelft WJJ, et al. Spinal manipulative therapy for chronic low-back pain. Cochrane Database Syst Rev 2011;2:CD008112.

11 Gross A, Langevin P, Burnie SJ, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. Cochrane Database Syst Rev 2015;9:CD004249.

12 Bertino RE, Talkad AV, DeSanto JR, et al. Chiropractic manipulation of the neck and cervical artery dissection. Ann Intern Med 2012;157:150-2.

13 Sing S. Beware the spinal trap. 2009; 29 July. http://resources.bmj.com/bmj/about-bmj/about-bmj/web-extras/Singh_chiropractic_2-D0B0BB.DOC.pdf.

14 Hondras MA, Linde K, Jones AP. Manual therapy for asthma. Cochrane Database Syst Rev 2005;2:CD001002.

15 Beckmann MM, Stock OM. Antenatal perineal massage for reducing perineal trauma. Cochrane Database Syst Rev 2013;4:CD005123.

16 Bennett C, Underdown A, Barlow J. Massage for promoting mental and physical health in typically developing infants under the age of six months. Cochrane Database Syst Rev 2013;4:CD005038.

17 Patel KC, Gross A, Graham N, et al. Massage for mechanical neck disorders. Cochrane Database Syst Rev 2012;9:CD004871.

18 Furlan AD, Giraldo M, Baskwill A, et al. Massage for low-back pain. Cochrane Database Syst Rev 2015;9:CD001929.

19 Loew LM, Brosseau L, Tugwell P, et al. Deep transverse friction massage for treating lateral elbow or lateral knee tendinitis. Cochrane Database Syst Rev 2014;11:CD003528.

20 Tang JL, Zhan SY, Ernst E. Review of randomised controlled trials of traditional Chinese medicine. BMJ 1999;319:160-1.

21 Wang Y, Wang L, Chai Q, et al. Positive results in randomized controlled trials on acupuncture published in Chinese journals: a systematic literature review. Journal of Alternative and Complementary Medicine 2014;20:A129.

22 Ernst E. And this is why we might as well forget about Chinese acupuncture trials. 2014; 21 May. http://edzardernst.com/2014/05/and-this-is-why-we-might-as-well-forget-about-chinese-acupuncture-trials/.

23 Madsen MV, Gøtzsche PC, Hróbjartsson A. Acupuncture treatment for pain: systematic review of randomised clinical trials with acupuncture, placebo acupuncture, and no acupuncture groups. BMJ 2008;338:330-3.

24 Professor Richard Dawkins interviews professor Michael Baum for Channel 4's program series "Enemies

of reason.” 2007.

25 Sørensen TK, Pihl M. ”Vi må advare om de risici, der er, for at en nål punkterer en eller begge lunger”. Jyllands-Posten 2017; 30 Sept.

26 O'Mathúna DP. Therapeutic touch for healing acute wounds. Cochrane Database Syst Rev 2016;9:CD002766. WITHDRAWN.

27 So PS, Jiang Y, Qin Y. Touch therapies for pain relief in adults. Cochrane Database Syst Rev 2008;4:CD006535. WITHDRAWN.

28 Robinson J, Biley FC, Dolk H. Therapeutic touch for anxiety disorders. Cochrane Database Syst Rev 2007;3:CD006240.

29 Joyce J, Herbison GP. Reiki for depression and anxiety. Cochrane Database Syst Rev 2015;4:CD006833.Roberts L, Ahmed I, Hall S. Intercessory prayer for the alleviation of ill health. Cochrane Database Syst Rev 2007;24(1):CD000368.

30 Jørgensen KJ, Hróbjartsson A, Gøtzsche PC. Divine intervention? A Cochrane review on intercessory prayer gone beyond science and reason. J Negat Results Biomed 2009;8:7.

31 Leibovici L. Author's reply to Effects of remote, retroactive intercessory prayer on outcomes in patients with bloodstream infection: randomised controlled trial. BMJ 2002;324:1037.

32 Olshansky B, Dossey L. Retroactive prayer: a preposterous hypothesis? BMJ 2003;327:1465-8.

33 Bishop JP, Stenger VJ. Retroactive prayer: lots of history, not much mystery, and no science. BMJ 2004;329:1444-6.

34 Erratum to Does prayer influence the success of in vitro fertilization-embryo transfer? Report of a masked, randomized trial. J Reprod Med 2004;9:100A. Lobo, RA [removed].

35 Flamm B. The Columbia University 'miracle' study: flawed and fraud. Skeptical Inquirer 2004;28(5): http://www.csicop.org/si/2004-09/miracle-study.html.

36 James Randi Educational Foundation: The Columbia University scandal. 2004 http://www.randi.org/jr/121704no.html#2.

37 Flamm BL. Prayer and the success of IVF. J Reprod Med 2005;50:71.

38 Cha KY. Clarification: influence of prayer on IVF-ET. J Reprod Med 2004;49:944-5.

39 Bronson P. A prayer before dying. Wired 2002;10. http://www.wired.com/wired/archive/10.12/prayer_pr.html.

40 Liddle SD, Pennick V. Interventions for preventing and treating low-back and pelvic pain during pregnancy. Cochrane Database Syst Rev 2015;9:CD001139.

41 Gøtzsche PC. Rational diagnosis and treatment. Evidence-based clinical decision-making, 4th edition. Chichester: Wiley; 2007.

42 Coulter HL. Homoeopathy. In: Salmon JW, ed. Alternative Medicines. London: Tavistock; 1985.

44 Homeopathic dilutions. https://en.wikipedia.org/wiki/Homeopathic_dilutions.

45 Linde K, Clausius N, Ramirez G, et al. Are the clinical effects of homeopathy placebo effects? A meta-analysis of placebo-controlled trials. Lancet 1997;350:834–43.

46 Sterne JA, Egger M, Smith GD. Systematic reviews in health care: Investigating and dealing with publication and other biases in meta-analysis. BMJ 2001;323:101-5.

47 Martin D. EU votes to spend £1.8 million on homeopathy for farm animals. Daily Mail 2011;30 Aug.

48 Lethal advice from homeopaths about malaria prevention. 2006; 13 July. http://www.dcscience.net/2006/07/13/malaria_prevention/

49 House of Commons, Science and Technology Committee. Evidence check 2: homeopathy. Fourth report of session 2009-10.

50 Kaplan S. Hundreds of babies harmed by homeopathic remedies, families say. Scientific American 2017; 21 Feb. https://www.scientificamerican.com/article/hundreds-of-babies-harmed-by-homeopathic-remedies-families-say/

51 Maressa JE. Syv-årig drengs død udløser debat om naturmedicin i Italien. Jyllands-Posten 2017; 4 June.

52 Lønroth HL, Ekholm O. Alternativ behandling i Danmark – brug, brugere og årsager til brug. Ugeskr Læger 2006;168:682-6.

53 Ullman D. Homeopathic medicine: Europe's #1 Alternative for Doctors. 2011; 17 Nov. http://www.huffingtonpost.com/dana-ullman/homeopathic-medicine-euro_b_402490.html.