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ORIGINAL PAPER

First evidence of Beauvais' hypothesis in a plant model

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Introduction: **Beauvais presented the application of a so-called 'quantum-like model of homeopathy' by introducing the idea of a type of randomization/unblinding which he called '*in situ*'. He predicted that randomized studies based on this type of randomization/unblinding lead to more pronounced effects in placebo controlled randomized homeopathic trials. We designed an experiment regarding wheat germination and stalk length to investigate Beauvais' idea of '*in situ* randomization/unblinding' using a homeopathic dilution of sulphur (LM VI) as compared to placebo as well as to water.**
Aim and method: **The primary aim of this double-blind randomized controlled experiment was to investigate whether there are differences of '*in situ* randomization/unblinding' vs 'central randomization/unblinding' with respect to the effect of a homeopathic substance compared to placebo. The secondary aim of our study was to examine possible differences between the sulphur and the placebo group in the '*in situ*' arm regarding germination and/or stalk growth of wheat seedlings measured after a seven days exposure. Wheat was treated either with sulphur LM VI, placebo, or water. The wheat grains were placed on glass lids and treatment was performed following the '*in situ* randomization/unblinding' as well as 'central randomization/unblinding' method. Germination was measured and classified into three categories.**
Results: **Under '*in situ*' randomization/unblinding the odds of a seed not to germinate is 40% lower if treated with sulphur compared to placebo ($p = 0.004$). In contrast, these odds are practically equal in the 'central' meta-group (OR = 1.01, $p = 0.954$). Under '*in situ*' randomization/unblinding the odds of a seed to germinate with a length ≥1 mm is practically equal if treated with sulphur or with placebo (OR = 0.96, $p = 0.717$). In contrast, these odds are 21% higher under sulphur compared to placebo in the 'central' meta-group (OR = 1.21, $p = 0.062$). In summary, we found a sulphur effect that is significantly different between '*in situ*' and 'central' randomization/unblinding relating to all three stages of germination.** *Homeopathy* (2016) **105**, 270–279.

Keywords: Beauvais' hypothesis; Quantum-like model of homeopathy; Plant model; Wheat; Sulphur; *In situ* randomization/unblinding; Central randomization/unblinding

Introduction

The gold standard for assessing the efficacy of a medical treatment is the randomized controlled trial (RCT).[1] In his paper of 2013, Beauvais presented the application of a so-called 'quantum-like model of homeopathy' by introducing the idea of a type of randomization/unblinding which he called '*in situ*'.[2] He predicted that randomized

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studies based on this type of randomization/unblinding lead to more pronounced effects in placebo controlled randomized homeopathic trials.

In the past, randomized, blinded and placebo-controlled homeopathic studies were often unable to establish the evidence of an isolated effect, as opposed to randomized, but open comparisons.[3] Randomization and blinding are hypothesized to lead to an entanglement situation between homeopathy and the placebo group. Thus the effects between the groups are 'smeared', i.e. specific effects of the homeopathic medicine occur also in the placebo group. Beauvais' theoretical model assumes that a randomized, blinded, placebo-controlled study is formally analogous to a 'single-particle interferometer', a device demonstrating the quantum nature of photons. The special feature of the interferometer is that through mirrors and beam splitters the photon is not measured on its path, so it can spread as a wave. This is even the case if only one photon is sent through the apparatus, meaning a photon is travelling as a wave on two paths.[4] At the end an interference pattern is produced by the last mirror and the two wave components go into two detectors via a constructive and destructive interference, respectively.

According to Beauvais, a clinical situation ('open-label trial') in which the homeopath and the patient know which drug is prescribed is similar to the situation in which the photon is travelling as a wave. The hypothesised reason is that there is no external ('central') supervisor, who determines and controls the process from outside. The superposition is not prevented and a possible entanglement remains preserved. The situation of a randomized and blinded clinical trial, however, is comparable to the situation when a so-called 'which-path-measurement' is made.

In the interferometer analogy the probability wave collapses into a defined particle, meaning that the photons behave as particles. In accordance with the formalism they take either one or the other path and end up on the mirror devices again either in the one or in the other detector, with equal probability of one half. The superposition and the wave character disappear and the particle character emerges. A randomized, blinded clinical study ('centralized blinded RCT') is hypothesised to be an analogous case: it forces the system of patient, practitioner and remedy into a causal frame with the result that the probability of finding an effect is one half[2]: it shows up in the placebo or in the active treatment arm with equal probability.[5]

To meet these challenges Beauvais proposed to perform randomization and unblinding as close as possible to the patient as follows: randomization is done by the prescribing physician on the spot ('*in situ*') and, after the treatment period and directly after measuring the clinical outcome, to unblind it to both, the patient and the practitioner. This approach is contrary to the common conduct of clinical studies where randomization is done by a central institution or person and unblinding takes place for the whole data set after the data of all patients have been entered into a data base.

The considerations of Beauvais may be compared with those of Milgrom.[6,7] There, the importance of (double-) blinding in RCTs is also stressed. A quantum-like formalism that includes entanglement is proposed, the double-slit experiment being used as illustrative example. In the case of RCTs, macroentanglement should be considered. Then, the quantum mechanical formalism is used in a metaphorical way[6] or in the form of generalized quantum theory.[7]

Two kinds of entanglements are considered by Milgrom: PPR entanglement (between the patient, practitioner and remedy) and that between verum and placebo. Interestingly, the blinding procedure (partly) destroys the PPR entanglement, whereas it establishes verum-placebo entanglement. Then, verum and placebo effects do not differ significantly from one another.

This may be compared with Beauvais. Instead of PPR entanglement, the cognitive state of the couple patient/practitioner is considered, but not explained in detail. In principle, this cognitive state is able to interfere with itself (corresponding to entanglement). Usual central randomisation, however, destroys this superposition. At the same time, verum and placebo effects become similar or identical, which is called 'smearing effect' by Beauvais.

Even if the model of Beauvais is not sophisticated enough to explain all results of experiments or trials, he makes a concrete proposal concerning a new mode of randomisation ('*in situ*'). It can easily be tested whether this increases the efficacy of homeopathic treatment. The present paper tries to investigate Beauvais' theory in an experimental setting.

For our present study we chose a plant model for the homeopathic basic research experiment to test Beauvais' hypothesis. The testable prediction is that the difference between placebo and homeopathic remedy vanishes in centralized blind trials due to 'smearing' (i.e. specific effects occurring in the placebo group), while 'smearing' is avoided by *in situ* randomization/unblinding. In the '*in situ*' setting, it is a prerequisite that the treatment allocation is done in a locally defined order (*in situ* randomization) and that the results are recorded in an unalterable way before locally unblinding the allocated treatment. As already stated by Atmanspacher,[8] further developed by Walach[9] and by Milgrom,[10] it is expected that non-local factors will lead to resistance to reproducibility due to counterintuitive phenomena and a quantum entanglement.[11]

Almirantis even hypothesizes that 'significance' conveys to cell cultures, plants and physiochemical systems.[12] Based on all these considerations, our idea was to develop a laboratory experiment for plants. This experiment includes the possibility to directly compare Beauvais' '*in situ* randomization/unblinding' with the common 'central' way. The three groups to be compared within each form of randomization/unblinding are homeopathic medicine (globules of sulphur LM VI) plus Volvic water (as nutrient solvent), a control substance (placebo globules) plus Volvic water (as nutrient solvent), and Volvic water alone.

We designed an experiment regarding wheat germination and stalk length to investigate Beauvais' idea of '*in situ* randomization/unblinding' using a homeopathic dilution of sulphur (LM VI) as compared to placebo as well