

## EPIDEMIOLOGICAL STUDIES ON THE EFFECTS OF PRENATAL ULTRASOUND EXPOSURE IN HUMANS: CASE OF HANDEDNESS

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Diagnostic Ultrasound, the cheapest tool of its kind, has the reputation of being among the safest methods of medical imaging. *Getting harmful is a matter of thresholds.* For instance cavitation occurs when Ultrasound is used for treatments. But diagnostic Ultrasound is different. Common sense tells that a temperature rise of 4 degrees Celsius would be harmful. Animal studies have shown that with increasing exposure time (several minutes for 2 degrees or so), even a smaller rise would suffice [1]. Uncertainties about local fluctuations, or about the operator not being knowledgeable enough have been suggested. *Epidemiological studies could directly inform if the prenatal ultrasound exposure is associated with postnatal outcomes.* What is known is that the hypothesis of the harmful effects of Ultrasound is based on a chain of inconsistent epidemiological studies. These can live on because of the delicate subject of pregnancy health care.

The hypothesis comes from a Norwegian Randomized Controlled Trial (RCT) [2], the unorthodoxy of which was to fail in confirming initial doubts of increasing Dyslexia and then turning to split data by sex and to present a final doubt of an increase of left-handedness in boys. To make sure, they tested five other traits. Our own RCT study [3] failed to confirm the association between prenatal ultrasound exposure and left-handedness: ODDS RATIO = 1.12, CI = (0.89-1.41). Another side in the failure is however a tendency of Randomized Controlled Trials on humans to get compromised, for ethical reasons. Much of the power was lost. Most importantly the hypothesis was not confirmed. - A meta-analysis of Ultrasound effects has been reproduced by Salvesen [4]. Final summary: Ultrasound cannot be regarded harmful because real neurological defects are not involved. As a rule left-handedness should be regarded normal.

[1] Hill sCR, Bamber JC, Haar GRt. Physical principles of medical ultrasonics. 2nd ed. Chichester: John Wiley & Sons; (2004), pp 467-480.

[2] Salvesen KA, Vatten LJ, Eik-Nes SH, Hugdahl K, Bakketeig LS. Routine ultrasonography in utero and subsequent handedness and neurological development. *BMJ* (1993) Jul 17;307(6897):159-164.

[3] Heikkilä K, Vuoksima E, Oksava K, Saari-Kemppainen A, Iivanainen M. Handedness in the helsinki ultrasound trial. *Ultrasound Obstet Gynecol* (2011) Jun;37(6):638-642.

[4] Salvesen KA. Ultrasound in pregnancy and non-right handedness: meta-analysis of randomized trials. *Ultrasound Obstet Gynecol* (2011) Sep;38(3):267-271.