Can caesarean sections increase susceptibility to disease?

April 24 2013, by Hannah Dahlen

Credit: AI-generated image (disclaimer)

Despite efforts to reduce intervention rates during labour, vaginal births without medical intervention are becoming increasingly rare in Australia and overseas: nearly one in three women in Australian now give birth by caesarean; more than half are induced or have the process sped up with drugs; and 50% are given antibiotics to reduce the risk of infection.

Much of the research on the effects of intervention during birth has focused on short-term outcomes of mother and baby. But what if were unknowingly reshaping society through the way our children were born?

Scientists are increasingly realising that the genetic legacy we pass on to our offspring is not hardwired. Rather, genes and susceptibility to disease can be activated or deactivated by lifestyle factors and experiences such as diet, stress, exposure to toxins – and childbirth. This relatively new field of study is called epigenetics, which literally means above genetics.

Researchers have shown epigenetic changes can occur during pregnancy and in the first few months after the birth. But to date, epigenetic influences during the actual labour and birth have rarely been studied. This is probably because researchers thought the labour and birth period was too short to lead to epigenetic changes.

To close this gap in knowledge, midwifery professors Soo Downe (University of Central Lancashire), Holly Powell Kennedy (Yale University) and I recently founded the international research group Epigenetic Imapact in Childbirth, or EPIIC. In January 2012 we brought together eleven researchers (midwives, scientists, epidemiologists, geneticists and epigeneticists) at the University of Hawaii and developed the EPIIC Hypothesis, which has just been published in the journal Medical Hypothesis.

We hypothesise that events during labour and birth – specifically the use of the synthetic hormone oxytocin, along with antibiotic use and caesarean sections – affect the epigenetic remodeling processes and the subsequent health of the mother and child.

We have known for a while now that caesarean section is linked to longer-term health implications for the child (such as type 1 diabetes,

gastroenteritis, asthma, allergies, some cancers, autoimmune disorders and so on). We also know the stress of being born is good for you.

But what happens if your a baby does not undergo a vaginal labour? Or experiences excessive stress with medical interventions such as forceps or vacuums? The increasing use of obstetric interventions during birth could be having an impact on the fetal epigenome. This is a profoundly disturbing hypothesis that warrants further investigation.

In the past, the hygiene hypothesis has been proposed as a possible explanation. It's based on the idea that over the past century, declining family size, improved household amenities and higher standards of personal cleanliness have reduced opportunities for cross infection in young families and this has led to more widespread allergies.

In the case of caesarean section, a hygiene hypothesis approach would suggest that the lack of exposure to vaginal flora may program the immune response of the child differently. A study published recently in the Canadian Medical Association Journal using DNA sequencing showed babies born by elective caesarean section lacked or had lower numbers of certain bacteria that are found in babies born vaginally. And we know disrupting gut microbiota has been linked to a range of diseases, such as inflammatory bowel disease, allergies, asthma, cancer, and so on.

But this is neither a necessary nor a sufficient explanation for the array of effects associated with childbirth interventions that are emerging in long-term research projects that track disease and health outcomes.

In the EPIIC hypothesis, we propose that physiological labour and birth have evolved to exert eustress (a healthy, positive form of stress) on the fetus, and that this process has an epigenomic effect on particular genes, particularly those that program immune responses, genes responsible for

weight regulation, and specific tumour-suppressor genes.

Reduced or elevated levels of the hormones cortisol, adrenalin, and oxytocin which are produced during labour may lead to fetal epigenomic remodelling anomalies which exert influence on abnormal gene expression. This reprogramming could manifest in a range of diseases and behavioural problems in the neonate and later on in the adult. This suggests that what goes on in labour and birth may be crucial to epigenetic remodelling.

Due to a dearth of research in this domain, epigenetic changes which may occur due to medical interventions and environment interactions remain unknown, as well as the health implications for mother and child. As we continue to test this hypothesis, hopefully we'll come closer to determining whether we're reshaping society by the way we are born.

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