











The potential for outdoor environments to supply beneficial butyrate-producing bacteria to humans

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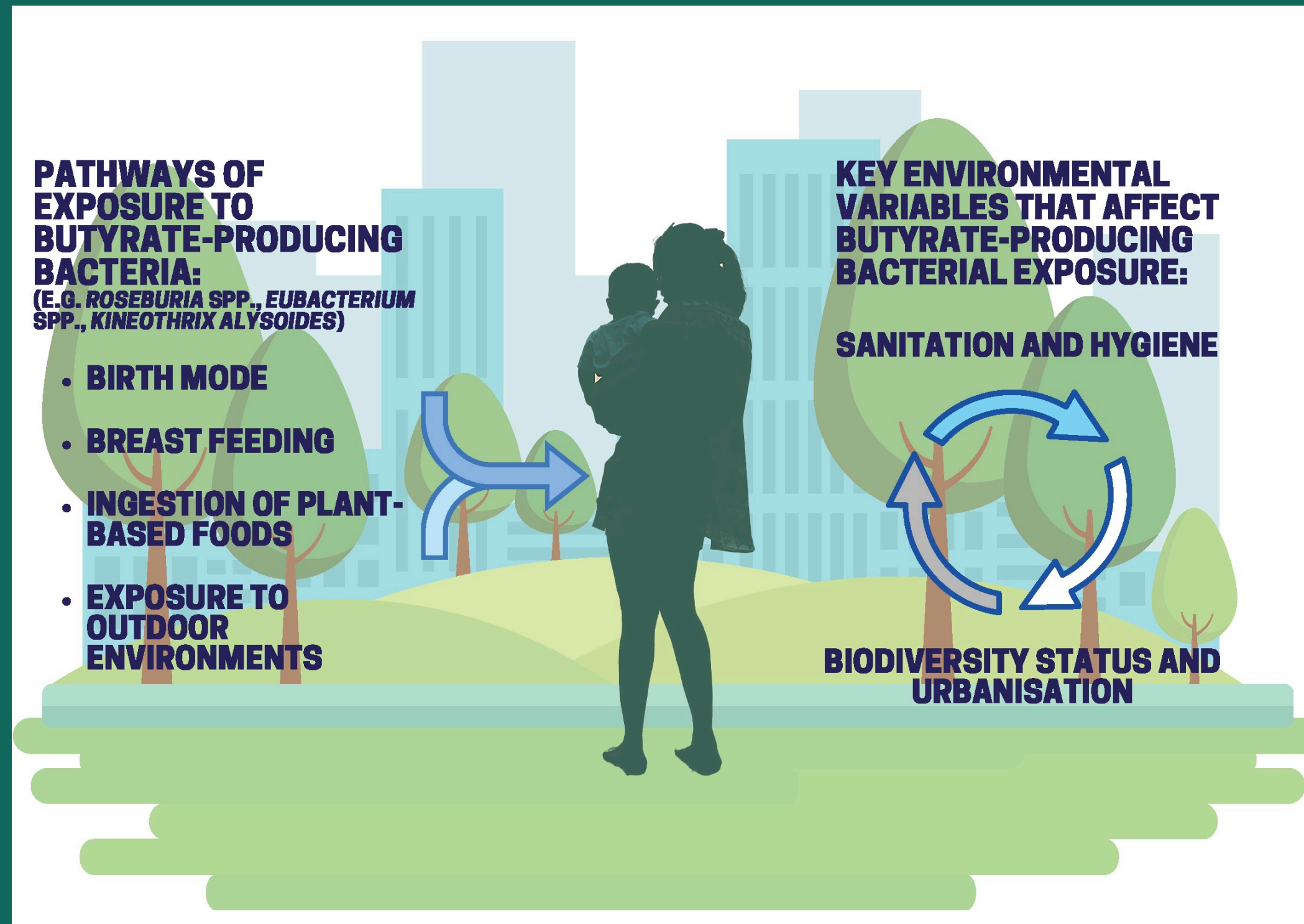
WHAT WE FOUND IN OUR REVIEW

1. Outdoor environmental sources of commensal butyrate-producing bacteria remain poorly understood.
2. Repeated cutaneous exposure to soils can modulate gut bacterial abundances.
3. Exposure to outdoor airborne microbiota can alter the abundances of microbiota on human skin and nose.
4. Bacteria can transfer via air from soils to animal hosts and alter gut bacterial abundances.
5. Biodiverse ecosystems may promote human health via increased exposure to butyrate-producing bacteria.
6. Biodiversity and Old Friends hypotheses offer possible connections between exposure to outdoor environmental microbiota and positive benefits on human health.

EFFECTS OF BUTYRATE IN PEOPLE:

-  Preferred energy source for colonic epithelial cells
-  Maintenance of the gut barrier
-  Regulation of mucus secretion at the colon
-  Support of IgA synthesis at the colon
-  Anti-inflammatory effects via regulatory T-cells and histone deacetylase inhibition
-  Protection from metabolic diseases
-  Reduction of depression and anxiety
-  Participation in the microbiome-gut-brain axis
-  Effects on ghrelin and glucagon-like peptide-1

Human-beneficial butyrate-producing bacteria can potentially be supplied by outdoor environments



WHY IT MATTERS

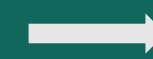
- Urbanisation is expanding and reduces critical human exposure to biodiversity and microbial “Old Friends”.
- Many gut bacteria benefit humans by producing metabolites, including short-chain fatty acids such as butyrate.
- Butyrate-producing bacteria abundances are reduced in a range of health conditions, including allergies, inflammatory bowel disease, and mental health.
- The loss of key gut microbiota (including butyrate-producers) from lifestyle factors such as antibiotics and low-fibre diet can compound over generations.
- Outdoor environments may be able to supply butyrate-producing bacteria to humans to restore their gut abundances.

HEALTH CONDITIONS ASSOCIATED WITH DECREASED BUTYRATE-PRODUCING BACTERIA:

- Inflammatory bowel disease
- Colorectal cancer
- Diabetes mellitus
- Allergies
- Autism
- Mental health conditions (e.g. anxiety)
- Asthma
- Multiple sclerosis
- Rheumatoid arthritis
- Chronic kidney disease
- Obesity/metabolic disease
- Atherosclerosis



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