Babies have fewer respiratory infections if they have well-connected bacterial networks

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Microscopic bacteria, which are present in all humans, cluster together and form communities in different parts of the body, such as the gut, lungs, nose and mouth. Now, for the first time, researchers have shown

the extent to which these microbial communities are linked to each other across the body, and how these networks are associated with susceptibility to respiratory infections in babies.

In a presentation at the European Respiratory Society International Congress today, Dr. Melanie Clerc, a post-doctoral researcher at the Centre for Inflammation Research, University of Edinburgh (UK), said that infants whose microbial communities (known as microbiota) were organised into networks of large, well-connected clusters had fewer respiratory infections than those with more fragmented networks.

She said: "We know already that bacteria in the gut and respiratory tract are independently associated with susceptibility to and severity of respiratory infections. Up until now, however, researchers have mostly focused on the links between a particular disease and either the bacteria in the gut or the local bacterial community at the site of disease, like the lungs. We believe we are the first group to show the extent to which microbial communities are linked across different sites in the body, and that having a well-structured, stable microbial network from an early age can be linked to improved respiratory health over the first year of life."

The researchers, led by Professor Debby Bogaert, collected samples one week after birth and then at two, four and six months from the nose, mouth and gut of 120 healthy babies who were enrolled in the large prospective Microbiome Utrecht Infant Study in The Netherlands. The researchers also gathered information on lifestyles and environmental factors affecting the babies, and how many respiratory infections they developed in the first year of life.

Dr. Clerc said: "We analysed the bacteria present in the nose, mouth and gut at multiple timepoints and used a mathematical algorithm to create networks that describe how all of those microbes are linked at each timepoint and over time."

The researchers found that one week after birth the microbial networks were already well-defined in babies who went on to experience 0-2 infections in the first year of life. These networks were composed of four large clusters of bacteria: three clusters were specific to either the nose, the mouth or the gut, and a fourth cluster of bacteria, composed of species of mixed origin, linked the other three groups. The size, composition and connectivity of these clusters remained stable during the year.

"However, the networks from children who developed more respiratory tract infections showed small, less-well connected clusters from early on in life, and they tended to change more over time, even before infections occurred," said Dr. Clerc.

"Our findings may lead to new insights into ways of using these cross-site microbial connections to prevent respiratory infections in childhood and to understand how susceptibility to disease is linked to the way these microbial communities mature. Further, interventions immediately before or after birth, such as caesarean section or antibiotic treatment, might have more impact than we previously predicted because of their extended effect on the ways microbial communities across the body are connected."

The researchers plan to study the specific mechanisms by which bacteria communicate with each other across different sites in the body, and what is driving these networks, in order to better understand the implications of the connections. They will also be investigating how the communication networks are affected by medical interventions around the time of birth and also by the method of feeding.

The babies were recruited before birth at the Spaarne Hospital in The Netherlands during routine prenatal appointments with midwives and obstetricians. Only healthy children were included, and those that were

born early or with congenital abnormalities or complications around the time of birth were excluded from the study.

Professor Tobias Welte from Hannover University, Germany, is President of the European Respiratory Society and was not involved in the study. He said: "This study provides some interesting data to show that by assessing the microbial networks of babies early on, we may be able to identify those who are more susceptible to respiratory infection. This could help healthcare professionals to prevent infection and offer treatment more quickly, which would protect the health of babies and improve patient outcomes, as prevention and early treatment are key to minimising the potential for long-term respiratory health effects following infection in early life.

"Although the methods described in this study may offer a new way of identifying babies who are at greater risk of infection, we need more research to confirm the link between microbial networks and respiratory effects and the potential for increased susceptibility to respiratory infection."

More information: Abstract no: PA4996, "Maturation of microbial networks across body sites is associated with susceptibility to childhood respiratory infections", by Melanie Clerc et al; "Novel findings in paediatric respiratory infections" poster session, 14.45-16.45 hrs CEST, Tuesday 1 October, room 6B.

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