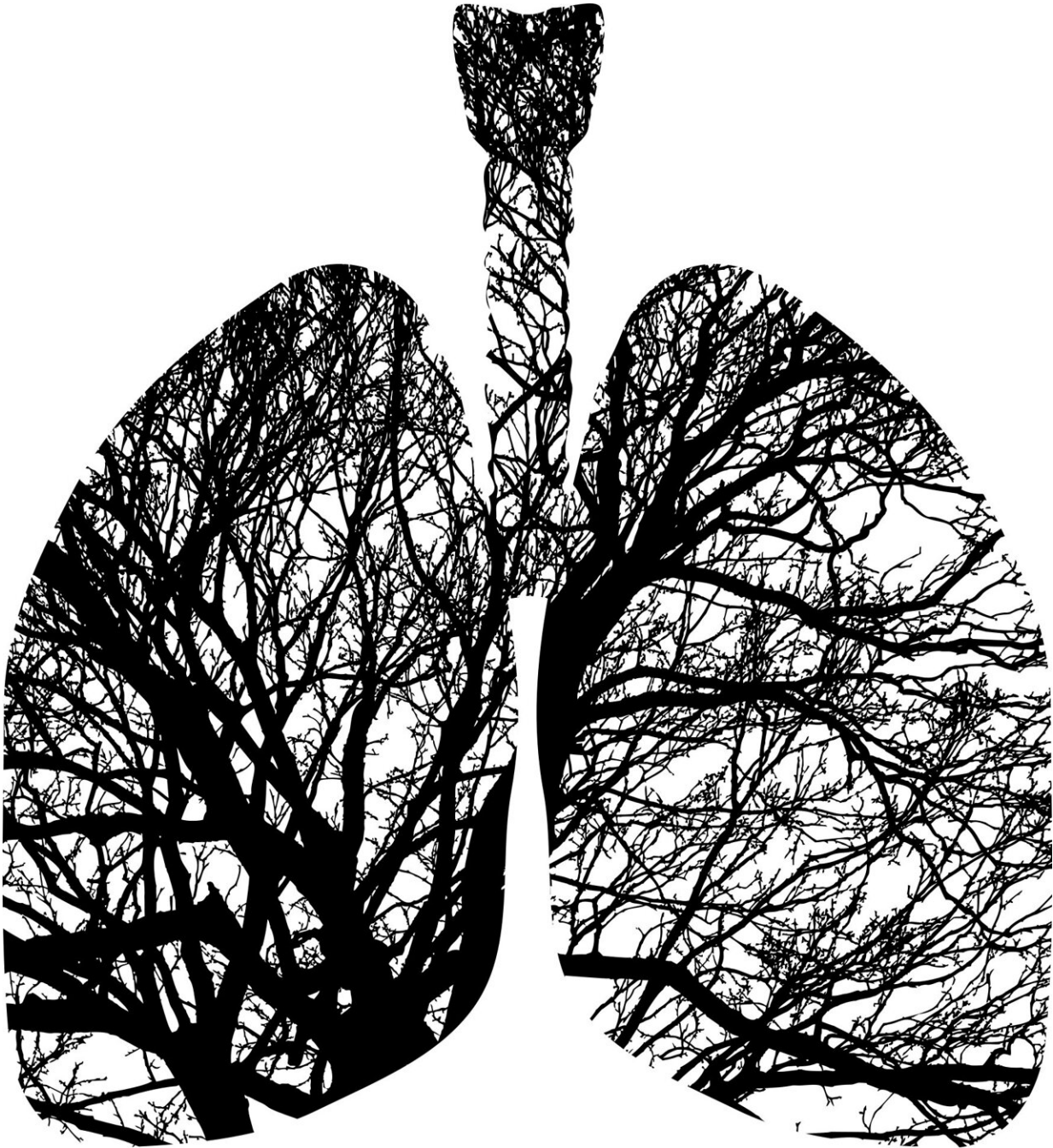


# How a leaky gut leads to inflamed lungs

May 11 2022, by Greg Glasgow

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Why are older adults more likely to get seriously ill or even die from pneumonia? It turns out the cause may have as much to do with the gut as it does with the lungs.

That's according to new research from Rachel McMahan, Ph.D., assistant research professor of GI, trauma, and endocrine surgery in the University of Colorado School of Medicine, and CU School of Medicine immunology graduate student Holly Hulsebus.

In a paper published in March in the journal *Frontiers in Aging*, the researchers—along with senior author Elizabeth J. Kovacs, Ph.D., professor of GI, trauma, and endocrine surgery—looked at the bacteria *Streptococcus pneumoniae* in animal models, studying changes in intestinal microbial populations after infection.

"*Streptococcus pneumoniae* is normally carried in the nasal passages of healthy adults. People with healthy immune systems can just live with it, and it doesn't cause any problems," Hulsebus explains. "But people with compromised immune systems, including [older adults](#), tend to become more susceptible because their immune system can't really control the bacteria that are normally there. Those bacteria can leave the nose and move to other places in the body. They can cause ear infections, and they also can spread to the lungs and cause pneumonia."

## **The role of the leaky gut**

In addition to increased morbidity and impaired [lung](#) function after a *Streptococcus pneumoniae* infection in older mice, the researchers also

found elevated levels of gut-derived bacteria in the lungs, suggesting that bacteria that migrate from the intestine to the lungs may partially be responsible for the poor outcomes in older individuals.

A likely reason for that migration, McMahan says, is that as we age, our guts become "leaky" as the mechanisms the body has in place to keep gut bacteria in place start to break down. This is similar to what happens with burn trauma patients and people who abuse alcohol. Compounding the problem is that inflammation in the body naturally increases with age, causing more pro-inflammatory bacteria to be present in the gut.

In their published study, funded by the National Institute on Alcohol Abuse and Alcoholism at the National Institutes of Health, the researchers found elevated levels of the Enterobacteriaceae family of bacteria—a gut-specific bacteria that includes *E. coli*—in the lungs of aged, but not young animal models, infected with *Streptococcus pneumoniae*. As Enterobacteriaceae is associated with increased inflammation, the researchers also discovered higher levels of neutrophils, a type of inflammatory immune cell, in the lungs of the aged infected animal models.

"Our working theory is that as you age, you have a heightened baseline inflammatory response, which then induces the gut to be more pro-inflammatory," McMahan says. "That causes potentially pathogenic bacteria in the gut to leak out into the organs, and then things can go downhill fast."

## **New strategies for fighting infection**

Older adults are nearly five times more likely to be hospitalized following a pneumonia infection, and mortality rates from pneumonia can exceed 50%, depending on co-morbidities or underlying health conditions. With the [global population](#) of those over the age of 65

growing rapidly, it's important to find new ways to combat severe infection.

A focus on the gut, McMahan says, may help researchers find new ways to combat increased inflammation in the lungs.

Strategies like probiotics and a healthy diet could help keep gut bacteria in check in aged individuals, she says, as could drugs that protect against gut leakiness. Future research in the lab includes investigating the effectiveness of microbiome transplants or fecal transplants that replace the bacteria in the aging gut with that of younger animals.

The gut-lung axis has long been studied in the context of diseases such as acute respiratory stress disorder, but the new paper from the CU School of Medicine researchers is among the first to describe the way in which aging can contribute to the problem.

"We're showing that as you age, you're specifically getting expansion of these [bacteria](#), and that the gut-lung axis may be impaired," McMahan says.

**More information:** Rachel H. McMahan et al, Age-Related Intestinal Dysbiosis and Enrichment of Gut-specific Bacteria in the Lung Are Associated With Increased Susceptibility to *Streptococcus pneumoniae* Infection in Mice, *Frontiers in Aging* (2022). [DOI: 10.3389/fragi.2022.859991](#)

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