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Study shows why cigarette smoke makes flu, other viral infections worse

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A new study by researchers at Yale School of Medicine could explain why the cold and flu virus symptoms that are often mild and transient in non-smokers can seriously sicken smokers. Published in the *Journal of Clinical Investigation,* the study also identified the mechanism by which viruses and cigarette smoke interact to increase lung inflammation and damage.

Until recently, scientists haven't been able to explain why smokers have more exaggerated responses to viral infections. Smokers have been more likely than non-smokers to die during previous influenza epidemics and are more prone to chronic obstructive pulmonary disease (COPD). Furthermore, children who are exposed to second-hand smoke have more severe responses when infected with respiratory synctial virus.

The prevailing view has been that cigarette smoke decreases anti-viral responses. But the Yale researchers—lead author Jack A. Elias, M.D., the Waldermar Von Zedtwitz Professor of Medicine and chair of internal medicine at Yale School of Medicine, and first author Min-Jong Kang, M.D., associate research scientist—found the opposite to be true.

Their experiments showed that the immune systems of mice exposed to cigarette smoke from as little as two cigarettes a day for two weeks overreacted when they were also exposed to a mimic of the flu virus. The mice's immune systems cleared the virus normally but the exaggerated inflammation caused increased levels of tissue damage.

"The anti-viral responses in the cigarette smoke exposed mice were not only not defective, but were hyperactive," said Elias. "These findings suggest that smokers do not get in trouble because they can't clear or fight off the virus; they get in trouble because they overreact to it."

"It's like smokers are using the equivalent of a sledge hammer, rather than a fly swatter, to get rid of a fly," said Elias.

The team found that mice with viral infections that had been exposed to cigarette smoke had accelerated emphysema and airway scarring. Elias and his team also defined the signaling pathway that mediates this exaggerated innate immune response.

"If the exaggerated responses are verified in human studies, it will be the first explanation for why viral infections are more serious in smokers," said Elias. "Once verified, we can find ways to prevent the destruction of lung tissue and the higher illness and death among smokers."

"These studies have identified molecular pathways that can explain how cigarette smoke exposure and viral infections interact to make breathing problems worse in diseases like COPD," said James P. Kiley, director, Division of Lung Diseases of the National Heart, Lung, and Blood Institute. "With further research, these findings may even lead to more effective drug treatments for COPD."

Source: Yale University