
How smoking might exacerbate COVID-19 disease



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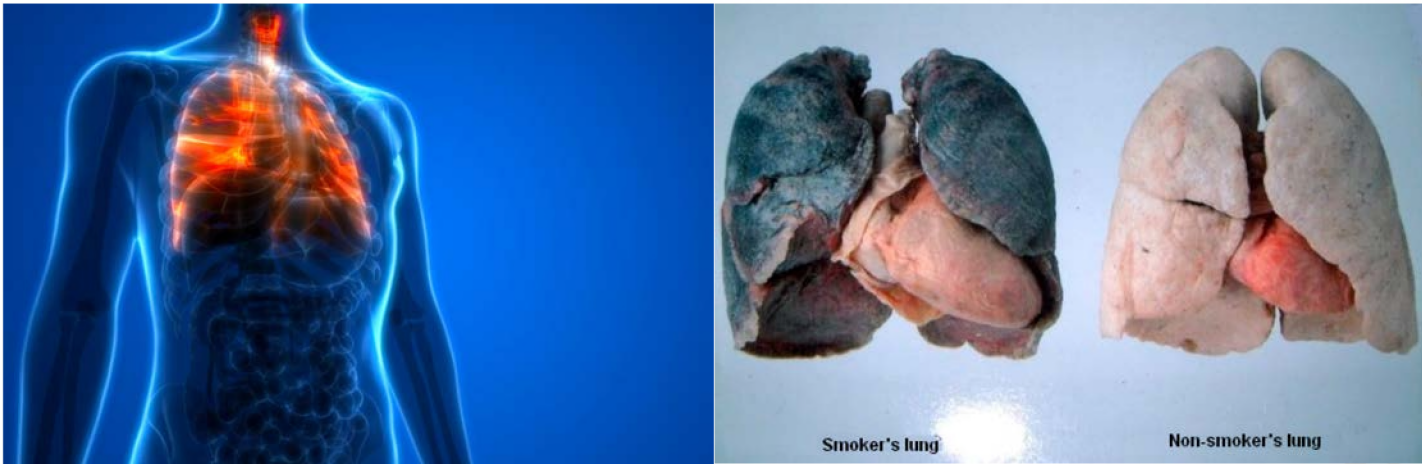


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Presentation Objectives

- In this presentation, you will be introduced to:
 - The general architecture of the lungs and lung epithelial tissue.
 - The basic of how the SARS-CoV-2 Virus infects cells.
 - The impact of cigarette smoke on the COVID-19 Disease.



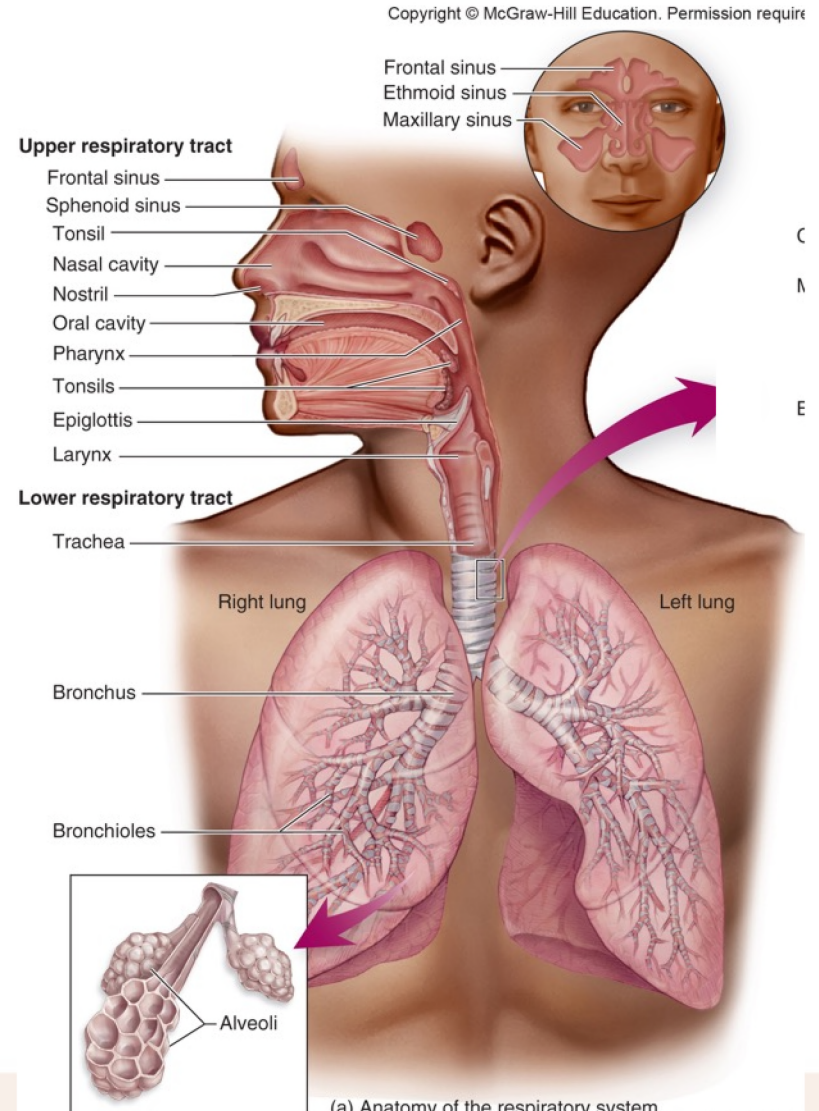
The Respiratory Tract Anatomy

- **Upper respiratory tract**

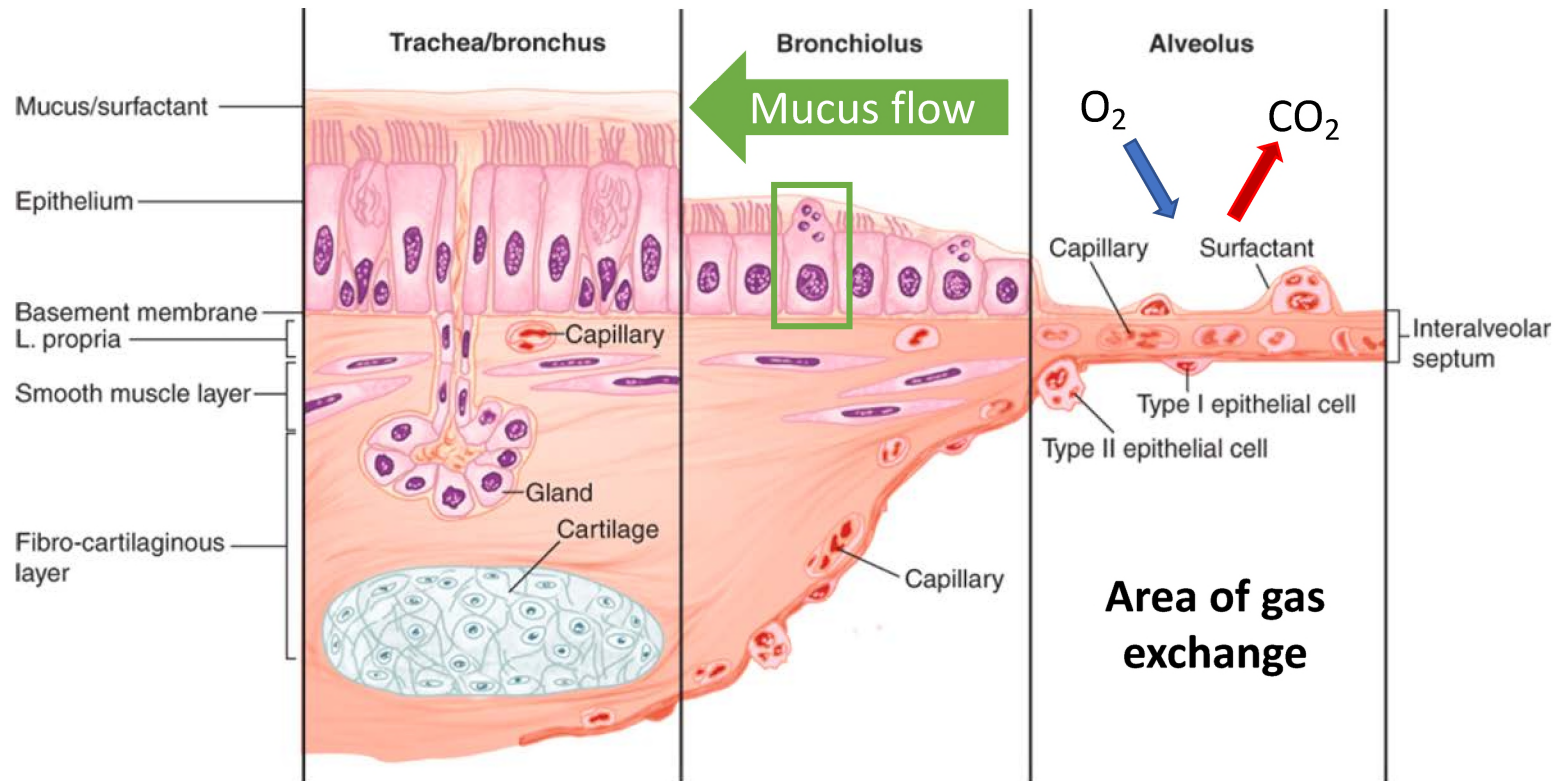
- Mouth
- Nose
- Nasal cavity
- Sinuses
- Throat (pharynx)
- Epiglottis
- Larynx

- **Lower respiratory tract**

- Trachea
- Bronchi
- Bronchioles
- alveoli



The lung cilia move mucus to the pharynx for clearance in the GI track



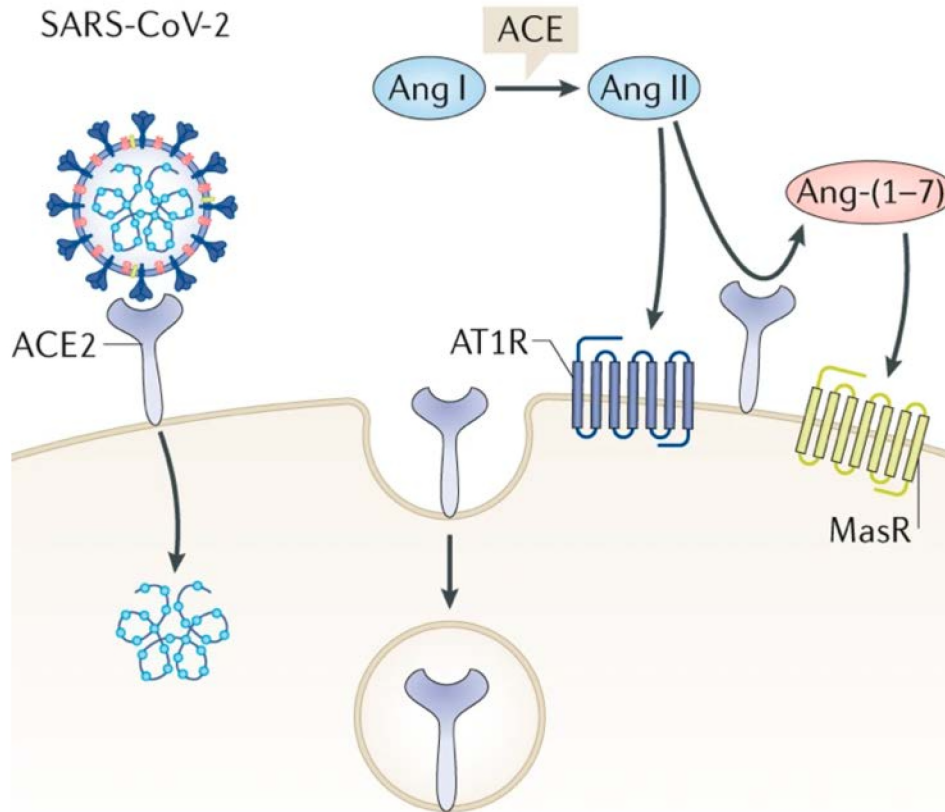
Source: K.E. Barrett, S.M. Barman, S. Boitano, J.F. Reckelhoff: Ganong's Medical Physiology Examination & Board Review: www.accessmedicine.com Copyright © McGraw-Hill Education. All rights reserved.

- The ciliary epithelium moves mucus to the trachea, where it passes the vocal cords and reaches the larynx.
- Mucus enters the pharynx and is swallowed (approximately 1 fluid oz of airway mucus/day).

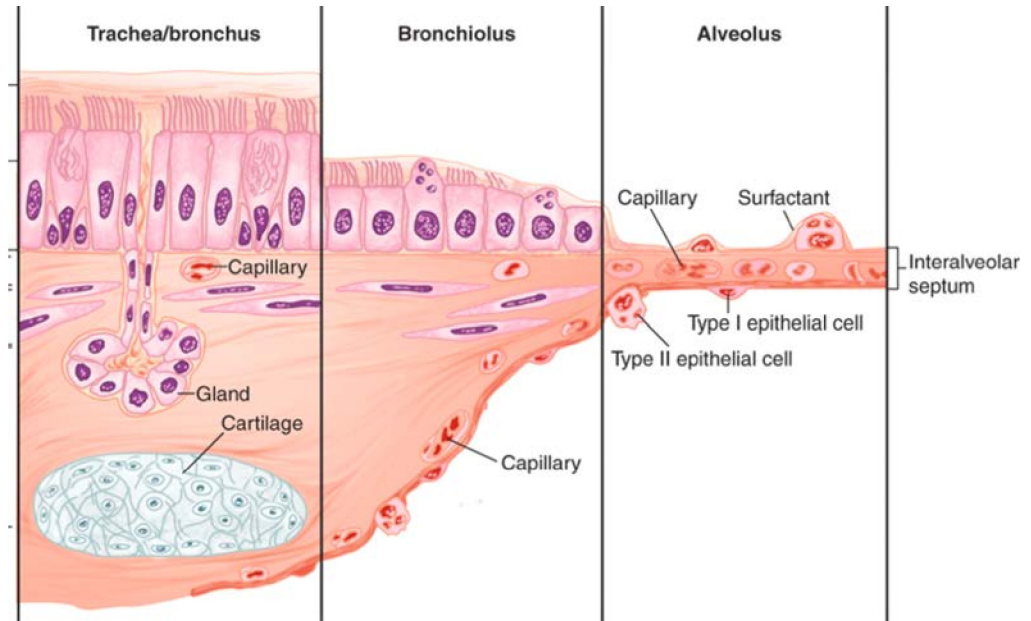
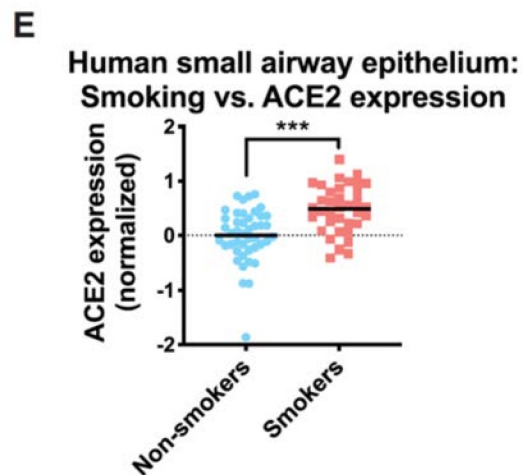
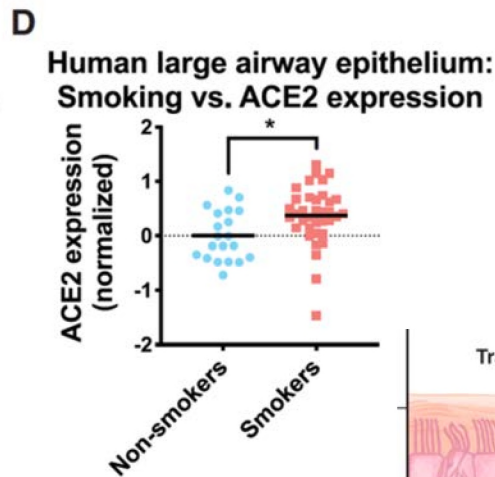
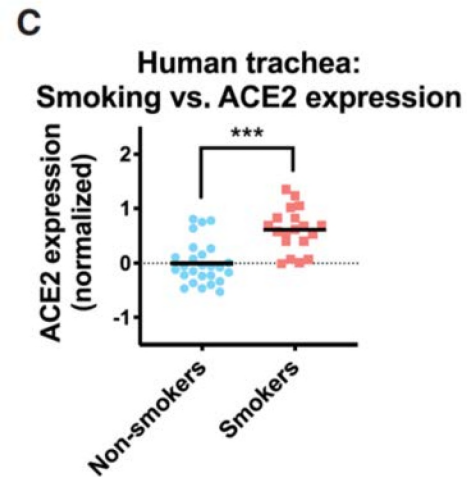


SARS-CoV-2 uses the angiotensin I converting enzyme 2 (ACE2) protein to infect cells

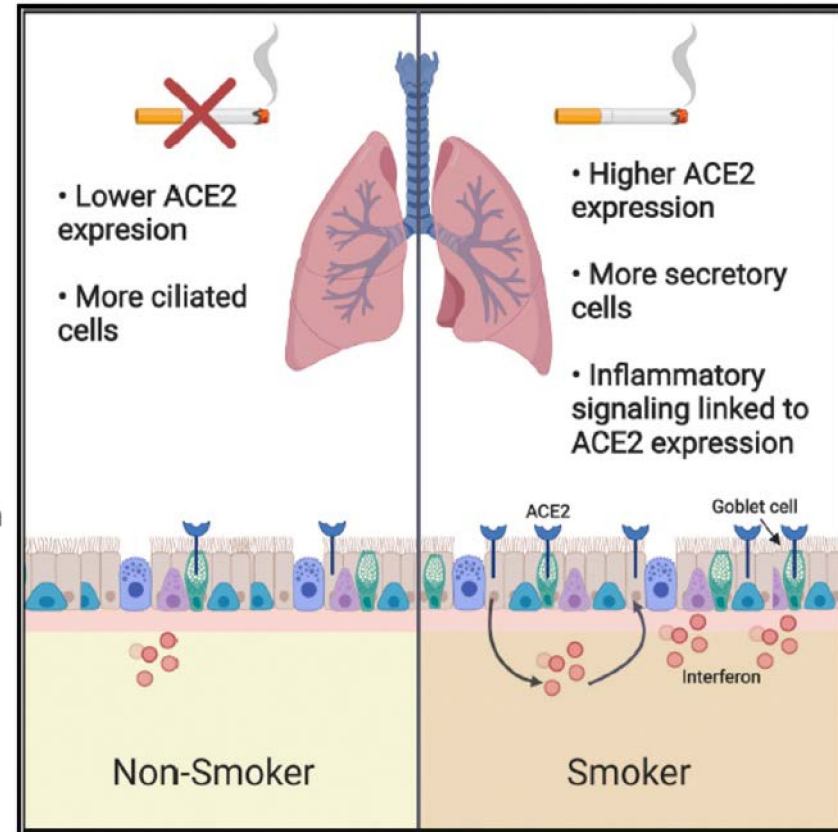
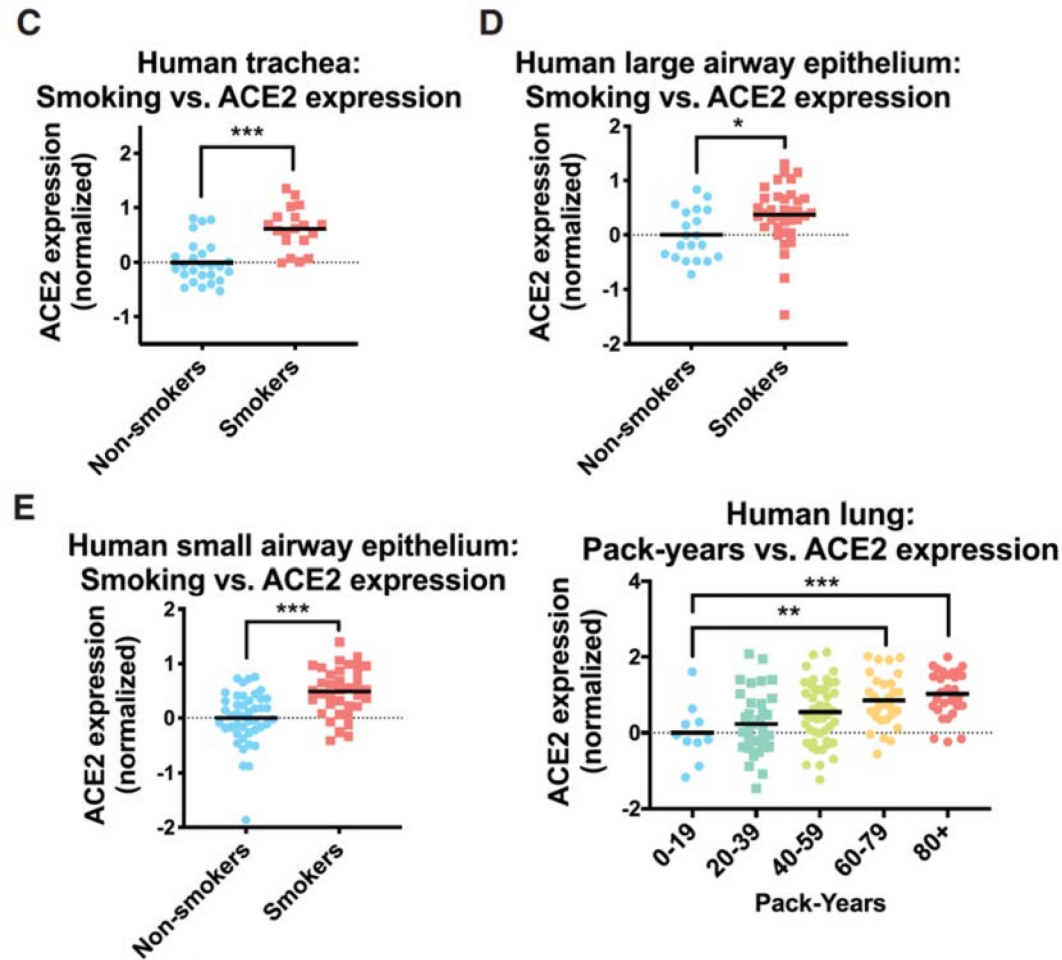
Viral binding



Smoke increases ACE2 expression in lung tissue

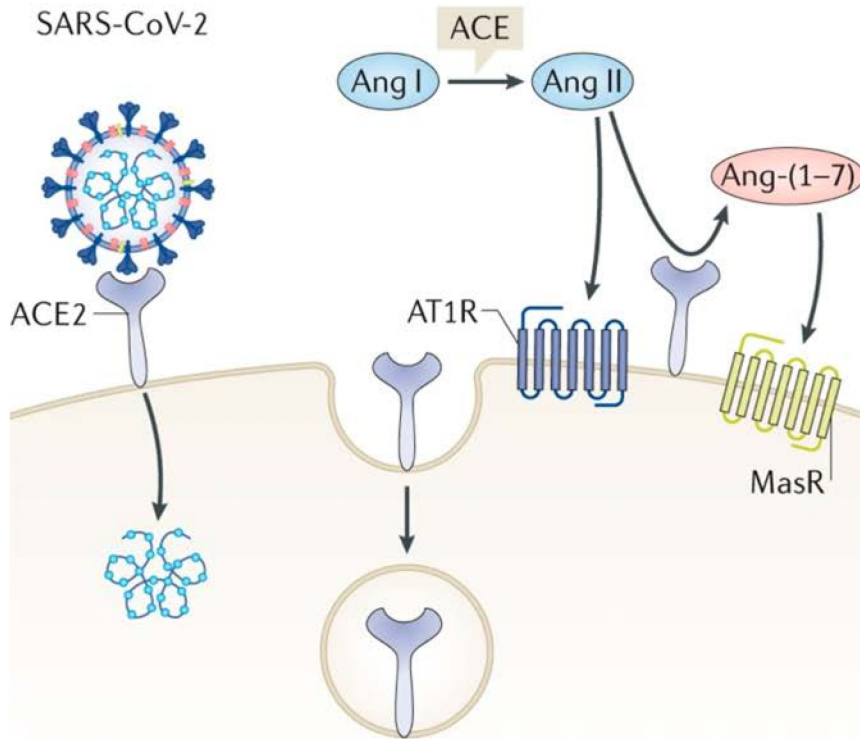


Smoke increases ACE2 expression in lung tissue

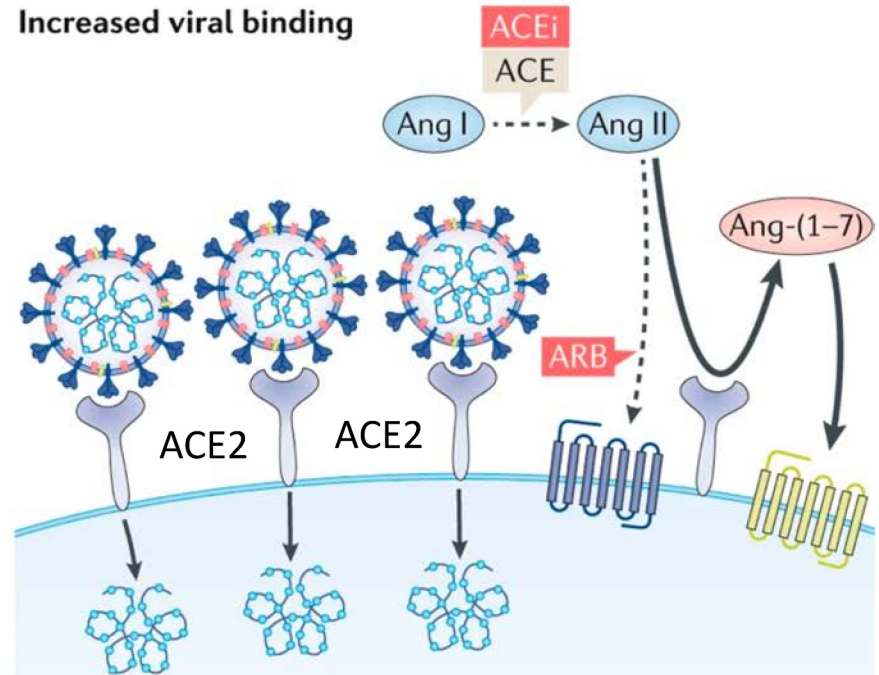


Increasing ACE2 receptors might increase viral infectivity

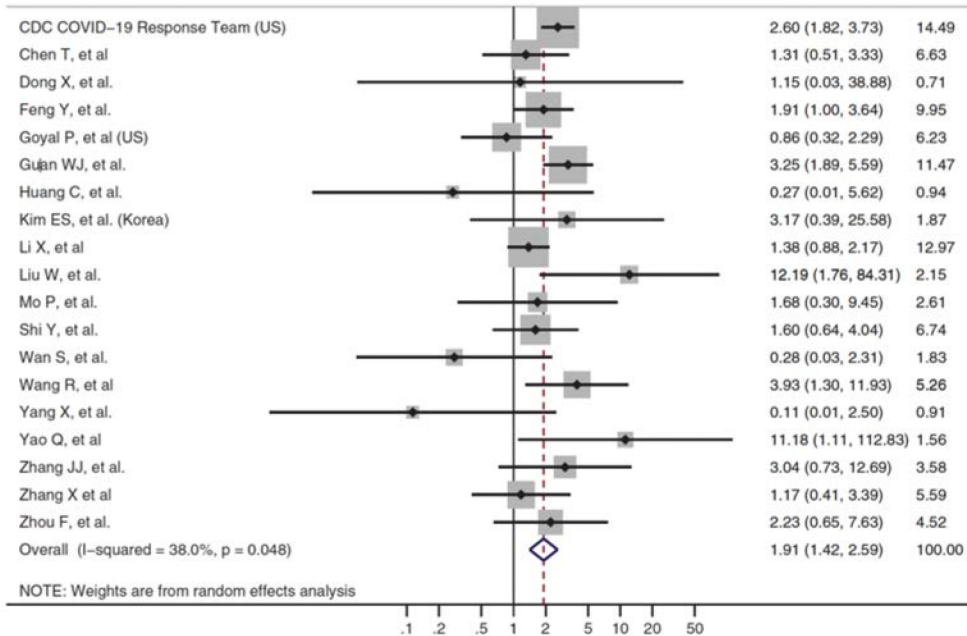
Viral binding



Increased viral binding



Smokers are almost 2-times more likely to have severe COVID-19 disease



- 218 smokers (29.8%) experienced disease progression, compared with 17.6% of non-smoking patients.
- Conclusion: significant association between smoking and progression of COVID-19 (**OR 1.91, 95% confidence interval [CI] 1.42-2.59, p = .001**).

Study	Smoking Events	Smoking Total	Non-smoking Events	Non-smoking Total	Odds Ratio	OR	95%-CI	Weight (fixed)	Weight (random)
X. Chen 2020	3	14	28	125	0.94	0.94	[0.25; 3.62]	16.9%	16.5%
W. Guan 2020	17	137	49	948	2.60	2.60	[1.45; 4.66]	41.4%	29.9%
C. Huang 2020	0	3	13	38	0.27	0.27	[0.01; 5.62]	8.4%	5.0%
W. Liu 2020	3	5	8	73	12.19	12.19	[1.76; 84.31]	1.6%	10.3%
X. Yang 2020	0	2	32	50	0.11	0.11	[0.01; 2.50]	11.5%	4.9%
F. Zhou 2020	5	11	49	180	2.23	2.23	[0.65; 7.63]	11.8%	18.1%
J. Zhang 2020	6	9	52	131	3.04	3.04	[0.73; 12.69]	8.5%	15.3%
Fixed effect model		181		1545	1.98	1.98	[1.29; 3.05]	100.0%	--
Random effects model					1.97	1.97	[0.95; 4.10]	--	100.0%

Heterogeneity: I² = 44%, τ² = 0.3797, p = 0.10

- smoking increases the risk of severe COVID-19 by around two-fold (**OR = 1.98; 95% CI: 1.29-3.05**).



Conclusions

- Smoking increases the expression of ACE2 protein in lung epithelial cells.
 - This might increase the infectability of lung tissue from smokers.
- Patients that smoke experience greater disease progression than non-smoking patients.
 - Meta-analysis of data from peer-reviewed papers



Questions

- UC Merced
 - Dept. of Psychology
 - Dr. Anna Song
 - Dept. of Molecular Cell Biology
- UC San Francisco
 - The Center for Tobacco Control Research and Education
 - Dr. Arthur Durazo

