Clinical Response to COVID-19: 
Lifestyle Strategies to Mitigate Risk

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Italy Coronavirus Deaths
By prior illnesses (%)

- 0.8% No other illness
- 25.1% 1 other illness
- 25.6% 2 other illnesses
- 48.5% 3 or more illnesses

Source: ISS Italy National Health Institute, March 17 sample
Underlying conditions among adults hospitalized with COVID-19


Source: MMWR. 2020 Apr 8:69(early release):1-7
Course of COVID-19 Infection

Severity of Illness

Time Course

Stage 1: asymptomatic
Viral response phase

Stage 2: non-severe symptomatic

Stage 3: severe respiratory-inflammatory
Hyperinflammatory phase
Cytokine Storm
# Course of COVID-19 Infection – A paradigm for therapy

<table>
<thead>
<tr>
<th>IMMUNE RESPONSE OVER TIME</th>
<th>INNATE IMMUNE ACTIVATION</th>
<th>ADAPTIVE IMMUNE ACTIVATION</th>
<th>CYTOKINE RELEASE SYNDROME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self limiting in 80%</td>
<td>Viral engagement of PAMPs</td>
<td>Generation of specific Abs and T cell response</td>
<td>IL-6, IL-1, TNF, GM-CSF, IFN, IFN</td>
</tr>
<tr>
<td>Severe in 15-20%</td>
<td>Low Type 1 IFN</td>
<td>Release of DAMPS</td>
<td>Coagulopathy</td>
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<tr>
<td>Fatal 1-2%</td>
<td></td>
<td></td>
<td>Complement</td>
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</table>

## Time Course

- **Quantitative viral load**
- **Viral response phase**
- **IgM response day 5-10**
- **Hyperinflammatory phase Cytokine Storm**
- **IgG response day 7-14**
Association of Blood Glucose Control and Outcomes in Patients with COVID-19 and Pre-existing Type 2 Diabetes

Graphical Abstract

Survival 98.9%

Well-controlled Blood Glucose (upper limit ≤ 10 mM)

Death 11.0%

Poorly-controlled Blood Glucose (upper limit >10 mM)

Diabetes

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In Brief
Type 2 diabetes (T2D) correlates with a worse outcome for COVID-19. Here, Zhu et al. show that among ~7,300 cases of COVID-19, T2D is associated with a higher death rate, but diabetics with better controlled blood glucose die at a lower rate than diabetics with poorly controlled blood glucose.
Developmental Cell
Available online 16 May 2020
In Press, Journal Pre-proof

Article
Cigarette smoke exposure and inflammatory signaling increase the expression of the SARS-CoV-2 receptor ACE2 in the respiratory tract

Joan C. Smith 1,2, Erin L. Sausville 2, Vishruth Girish 2,3, Monet Lou Yuan 2,4, Anand Vasudevan 2, Kristen M. John 2,5, Jason M. Sheltzer 2,5
- Lower ACE2 expression
- More ciliated cells

- Higher ACE2 expression
- More secretory cells
- Inflammatory signaling linked to ACE2 expression

Non-Smoker

Smoker
Extensive impact of non-antibiotic drugs on human gut bacteria

Lisa Maier¹a, Mihaela Pruteanu²a, Michael Kuhn²b, Georg Zeller², Anja Telzerow³, Exene Erin Anderson¹, Ana Rita Brochado¹, Keith Conrad Fernandez¹, Hitomi Dose³, Hirotada Mori³, Kiran Raosaheb Patil², Peer Bork²,⁴,⁵,⁶ & Athanasios Tyspas¹,²

A few commonly used non-antibiotic drugs have recently been associated with changes in gut microbiome composition, but the extent of this phenomenon is unknown. Here, we screened more than 1,000 marketed drugs against 40 representative gut bacterial strains, and found that 24% of the drugs with human targets, including members of all therapeutic classes, inhibited the growth of at least one strain in vitro. Particular classes, such as the chemically diverse antipsychotics, were overrepresented in this group. The effects of human-targeted drugs on gut bacteria are reflected on their antibiotic-like side effects in humans and are concordant with existing human cohort studies. Susceptibility to antibiotics and human-targeted drugs correlates across bacterial species, suggesting common resistance mechanisms, which we verified for some drugs. The potential risk of non-antibiotics promoting antibiotic resistance warrants further exploration. Our results provide a resource for future research on drug-microbiome interactions, opening new paths for side effect control and drug repurposing, and broadening our view of antibiotic resistance.

Pharmaceutical agents have both beneficial and undesirable effects. Studies on the mechanisms of action and off-target spectra of various drugs aim to improve their efficacy and reduce their side effects. Although many drugs have gastrointestinal side effects and the gut microbiome itself is pivotal for human health¹, the role of the gut microbiota in these processes is rarely considered. Recently, consumption of drugs designed to target human cells and not microbes, such as anti-

All compounds were screened at 20μM, which is within the range of what is commonly used in high-throughput drug screens⁹.

For our screen to be representative of the gut microbiome of healthy individuals, we selected a set of ubiquitous gut bacterial species (Supplementary Table 2). Prevalence and abundance in the human gut, and phylogenetic diversity, were our main selection criteria (Extended Data Fig. 1b), although we were occasionally constrained by strain unavailability. A total of 401 genera (Escherichia coli, Enterococcus faecalis, Bifidobacterium longum, and 56 others) were included.

24% of these human targeted pharmaceuticals inhibited growth of at least one important gut bacterial species...Study also implies an increasing risk of acquiring antibiotic resistance by being exposed to non-antibiotic drugs
Evidence that Vitamin D Supplementation Could Reduce Risk of Influenza and COVID-19 Infections and Deaths

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Abstract: The world is in the grip of the COVID-19 pandemic. Public health measures that can reduce the risk of infection and death in addition to quarantines are desperately needed. This article
Lifestyle plays a **critical** role in the cellular and clinical response to COVID-19
Lifestyle Changes to Reduce Inflammation

- Diet
- Exercise
- Sleep hygiene
- Stress management
- Smoking/vaping cessation
- Limit medication/USE appropriate medication
- Limit harmful chemical exposures
- Appropriate use of supplements
Key Supplements

- Vitamin D3
- Zinc
- Curcumin
- Vitamin C
- Quercetin
- B3 (niacin)
- Probiotic
- Vitamin A
- N-acetylcysteine (NAC)
- Melatononin
- Green tea (epigallocatechin gallate (EGCG))
Individual risk management strategy and potential therapeutic options for the COVID-19 pandemic

Amin Gasmi¹, Sadaf Noor², Torsak Tippairote³,⁴, Maryam Dadar⁵, Alain Menzel¹, Geir Bjørklund⁶*

Among the virus-contracted hosts, their different metabolic status, as determined by their diet, nutrition, age, sex, medical conditions, lifestyle, and environmental factors, govern the personal fate toward different clinical severity of COVID-19, from asymptomatic, mild, moderate, to death.