Slowing contagion

Orthodox and heretical thoughts on COVID-19

Amory B. Lovins, DSc h.c. mult. (not an MD)
Cofounder and Chairman Emeritus (Chief Scientist 2007–19)
Rocky Mountain Institute, www.rmi.org, ablovins@rmi.org

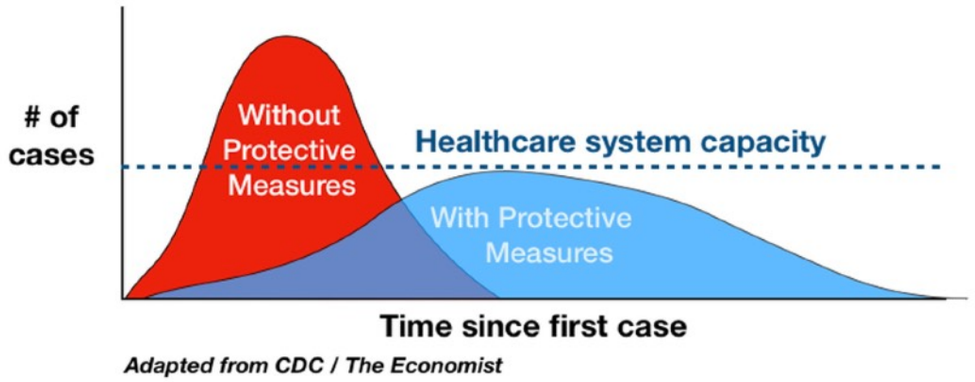
Advice from my physician advisors is gratefully acknowledged.
I am solely responsible for this content.—ABL

Singularity University webinar, 16 March 2020, updated 20 Mar 2020

Good day. I am not a physician and cannot offer medical advice. My informed lay advice here is worth what you paid for it. But from a half-century's experience as a transdisciplinary experimental scientist, long puzzled by the unusual epistemology of medicine (how docs do or don't know things), I hope these comments may stimulate some urgent rethinking of both orthodox and heterodox ways to respond to the COVID-19 pandemic.

Let me apologize in advance that after the next slide, my only graphic, this slide deck all a "text document." Preferring all graphics and no words, I haven't used that ugly word-thicket style for many years, but today I wanted to offer you a fairly detailed and lightly documented text that you could take away and mull over. *

“One chart explains why slowing the spread of the infection is nearly as important as stopping it.” — Siobhan Roberts



From Siobhan Roberts, “Flattening the Coronavirus Curve,” *NY* Times, 11 March 2020, https://www.nytimes.com/2020/03/11/science/coronavirus-curve-mitigation-infection.html

On 11 March 2020, the *New York Times* published a great chart derived from CDC and *The Economist.* It’s helping many people realize we must rapidly slow the spread of the infection so it does not outrun the capacity of our healthcare systems, because then many people could die from a lack of critical resources like ventilators and uninfected doctors and nurses. This graph illustrates one place (like the U.S. or part of it) over time, but the story of the 1918 influenza was similar, comparing red countries full of malnourished, stressed, scared, afflicted people with blue countries whose conditions helped people become less hospitable to the virus. *

Improving the immune and repair competences of the general population, while not conferring immunity, ***should slow contagion*.**

This seems mathematically equivalent to reducing R_0 (basic reproduction number), or to reducing the pathogen's virulence.* Stronger resistance should therefore **buy time** to:

- identify and isolate outbreaks
- improve and deliver therapies
- remedy deficits in test kits, ventilators, and other essentials
- develop and administer vaccines if that proves feasible

Milder, briefer infections—COVID-19 *and* all others—should also:

- reduce risks of serious COVID-19 infection in high-risk groups
- free up scarce healthcare resources, reducing risks from rationing
- reduce suffering and cost
- offer people practical, sensible options beyond handwashing and social distancing (both valuable, complementary, incomplete)

*A senior NIH official agreed a decade ago they hadn't modeled this approach but should. It's unclear whether this has yet been done, but the principle seems not to be in dispute. Spread depends on the virus's potential *and* on the host population's hospitality and societal responses.

* My core idea today is to focus public-health and personal efforts *not just on slowing the spread of COVID-19 by essential precautions like isolation, handwashing. and social distancing, but also by a portfolio of ways to* ***improve the immune and repair competences of the general population***. In the mathematics of epidemics, this has the same effect as making the pathogen less virulent, so each carrier infects fewer other people. This has two main benefits. * First, it *buys time* to identify and isolate outbreaks, improve and deliver therapies, make vital supplies we now lack, and develop and administer effective vaccines if those prove feasible. (That seems unlikely for this hypervariable single-strand RNA virus. Unless someone solves the extremely difficult problem of a universal vaccine against all coronaviruses, COVID-19 will be permanently with us like flu and colds, so our main defense will be our native immune competence). * Second, this focus on reducing host hospitality makes the infections that do occur *milder and briefer*—not just COVID-19 but *all* infectious diseases. This reduces comorbidity risks that probably dominate COVID-19 mortality; it reduces the currently alarming risk that people will die from triage if critical-care resources are rationed; it reduces suffering and cost; and it offers people sensible things they can easily do to complement the valuable but incomplete agenda now officially promoted, emphasizing handwashing and social distancing. * A decade ago, a top NIH official confirmed to me that enhancing general immune competence should be valuable but wasn't in their models of disease spread and should be. I don't know whether they've now modeled it, but our expert health agencies are not yet mentioning this approach. They advise how to avoid exposure to the virus—not how to help your immune system fight it. *

Oddly, this obvious approach is seldom discussed

- *NY Times* mentioned it first on 10 Mar 2020*, but omitted it when presenting the “flattening the curve” graph (slide 2) the next day, and in the splendid Kristof/Thompson simulation article 13 Mar. I submitted an op-ed 15 Mar.
- Not in Harry Stevens’s terrific *Washington Post* simulation 14 Mar.
- Not in Robert Baird’s fine *New Yorker* article 11 Mar 2020.
- Not in *Vox*’s great reading guide** or Hamblin’s 11 Mar *Atlantic****.
- Not on CDC or WHO websites.
- Two major medical journals and a leading scientific journal couldn’t find space for a brief letter suggesting the concept.
- People are hungry for protective advice—but half the big story they should be hearing is missing.

*“Can I Boost My Immune System?,” https://nyti.ms/38zSyTH **https://www.vox.com/2020/3/14/21175124/coronavirus-outbreak-covid-19-what-to-read-essential-reading-guide ***www.theatlantic.com/health/archive/2020/03/where-do-you-go-if-you-get-coronavirus/607759/

** *The New York Times* began to mention boosting immune competence on 10 March, but didn’t mention it again in two important articles in the next three days; we’ll see if they take my op-ed. * *The New Yorker* and *Vox* missed the point too. These otherwise great articles, like the CDC and WHO websites, suggested slowing the spread just by reducing exposure, but didn’t suggest improving immune competence. Three top journals didn’t consider that a priority either. But I think people would welcome hearing “the rest of the story.” *

How can we improve immune and repair competences?

1. Widely accepted ways to **take better care of yourself**
   - restorative sleep
   - mental well-being, calm, hope, de-stressing (e.g. meditation, yoga, controlled breathing)
   - strong and frequent hydration
   - sound and balanced nutrition
   - regular exercise
   - cut down alcohol (it's an immune suppressant)
   - avoid toxins
   - pH and other physiological balance

Your health depends on what you eat, drink, breathe, do, and feel. We know immunity matters, because people with weakened immune systems are more at risk from COVID-19, while most people infected with the same pathogen suffer mild or even no symptoms: they fight off the virus better.

Yet CDC.gov's COVID-19 content *does not mention any of these options.* Its "What you should know —steps to prevent illness" is solely about limiting spread, not also *reducing host hospitality* so as to decouple prevalence from incidence. *But both can slow the spread.*

** There are two main ways to improve our immune and repair competences. The first is widely, I daresay universally, accepted: * restorative sleep, * tranquility and stress management, * good hydration and * nutrition, * exercise, * moderation with alcohol, * avoidance of toxins, and * physiological measures like proper pH balance.

It seems obvious that * your health and your immune and repair competence will depend on what you eat, drink, breathe, do, and feel. So shouldn't the * world-class experts at CDC include these modalities in their extensive online content advising us all what to do about COVID-19? When the *Times* began to mention it six days ago [10 Mar 2020], they endorsed five of these items and omitted the rest. *

How can we improve immune and repair competences?

2. Controversial ways: **supplementation** with nutrients that the body needs but cannot make, notably:
    - vitamin C (slides 7–11)
    - vitamin D (the body can make this, but often too little for 50–80 ng/mL)
    - polyphenolics needed by first-line immune-defense dendritic cells (slide 13)
    - recycled *l*-glutamine to feed enterocytes
    - available magnesium
    - trace zinc/selenium
    - …

Official advice is typically* to "**skip unproven supplements**" (*NYT* 10 Mar 2020), notably vitamin C. *NYT* (10 Mar 2020, "Can I Boost My Immune System?") mentions vitamin D but not C. *NYT* 5 Mar 2020 says "*Don't believe the myths*. Vitamin C isn't an effective way to boost your immunity"—linked to 2 Mar: vit. C's "effectiveness is a longstanding fallacy." Harvard Med: "only marginally beneficial"; maybe therapeutic benefit at 8 g/d, but 2 g/d "can" cause GI symptoms, and doses >0.4 g "are excreted" (yup).

**Exception: NYT* 10 Mar 2020 does suggest you may wish to check your Vitamin D level and discuss with your doctor: "While more study is needed…some promising research suggests that checking your vitamin D level—and taking a vitamin D supplement—could help your body fight off respiratory illness." The anonymous article adds reservations but decently summarizes the potential, quoting one medical professor's approval. Yet *NYT* and CDC take the opposite (dismissive) approach to vitamin C, reject or omit zinc (*NYT* seems to confuse systemic ingestion with topical pharyngeal application), and omit other candidate supplements.

That article admits vitamin D and zinc lozenges may help, but otherwise says to "skip unproven supplements," meaning all the rest. They say to take none a day because this second portfolio of ways to strengthen immune and repair competence is considered controversial or worse, as I'll explain. I do think many mass-marketed dietary supplements are of unknown or poor quality, some are probably ineffectual, and some may be dangerous, so you won't find me in a standard vitamin store. But without making any blanket endorsement of indiscriminate supplementation, I'll discuss evidence about specific opportunities that look safe and effective. /
That 10 March *Times* article says "The National Institutes of Health has…cautioned that 'alternative' treatments are ineffective against COVID-19." It quotes a physician that high doses of vitamin C "do nothing to protect from the virus"—though he does recommend "healthy habits such as getting a good amount of rest, hydrating and eating fruits and vegetables." The other quoted physician didn't think any allegedly immune-boosting products had been proven to work. Even Harvard Med's website doesn't get it quite right either, as we'll see. *

Supplementation is officially viewed as of little value if not as outright quackery

- *NYT* and NIH cite the same sole evidence* for statements that vitamin C has no proven protective value against viral infections. They admit mild therapeutic value, but their message is generally dismissive**.
- Yet the very same study's senior author, Dr. Harri Hemilä, reports "all 21 placebo-controlled studies published since 1970 which utilize ≥1 g/day of vitamin C have reported a decrease in the severity of symptoms or in the duration of the common cold episodes"***, so "the current conception that vitamin C does not affect the common cold can be traced largely to the review Chalmers wrote in 1975"—which Hemilä then demolishes—while Chalmers is cited twice as often as Linus Pauling's unrebutted 1971 paper (*PNAS* **68**(11):2678–2681) that Chalmers attacked. Same for several other zombie papers.
- The L.A. City Attorney reportedly^ wants to prosecute as fraud claims "that vitamin C can protect against coronavirus infection," and WHO^^ to shut down "false reports that vitamin C can cure the coronavirus." Amazon is reportedly^^^ removing some vitamin C products due to curative claims considered false; can't check if they are because they're gone.
- This skepticism reflects a standard confusion of *absence of evidence* with *evidence of absence*. NCCIH got it right: "there is not enough evidence to show whether" vitamin C has preventive value.† We can't say either way.
- Solid evidence remains sparse because the dominant paradigm in evidence-based medicine *requires* large, long-term, controlled, usually randomized and double-blind, clinical trials—whose high cost industry and government won't fund for unpatentable over-the-counter supplements.
- The evidence that *does* exist is often misinterpreted: *e.g.* for vitamin C, which its advocates consider the most effective known way to combat viral infections (starting with a billion US colds per year, representative of viral respiratory infections)….

*H. Hamilä & E. Chalker (2013), "Vitamin C for preventing and treating the common cold," *Cochrane Systematic Review*, https://doi.org/10.1002/14651858.CD000980.pub4
**E.g., https://nccih.nih.gov/health/in-the-news-in-the-news-coronavirus-and-alternative-treatments
***https://www.mv.helsinki.fi/home/hemila/H/HH_1995.pdf ^https://ktla.com/news/coronavirus/l-a-county-cracking-down-on-price-gouging-and-scammers-as-coronavirus-fears-trigger-panic-buying/ ^^www.cnbc.com/2020/02/14/facebook-google-amazon-met-with-who-to-talk-coronavirus-misinformation.html † [https://nccihnih.gov/health/flu/indepth#hed4 ^^^www.bbc.com/news/technology-51675183

** Other than an NIH National Center for Complementary and Integrative Health posting [nccih/nih/gov/health/flu/indepth#hed4] that zinc lozenges can shorten colds, while both meditation and exercise may prevent and moderate them, I can't find any NIH posting that goes beyond the standard Cochrane Review of vitamin C that I'll discuss in the next three slides. NCCIH unhelpfully says of vitamin C, "the evidence is conflicting, inadequate, or mostly negative," as though those were identical. * Yet the Cochrane Review's senior author reports that *all 21* placebo-controlled studies published since 1970 using at least a gram of vitamin C per day have made colds milder or briefer. He traces "the current conception that vitamin C does not affect the common cold" to zombie papers that he and others debunked decades ago. And * now it's reported that the Los Angeles County Attorney wants to prosecute as fraud, and WHO to shut down, public claims that vitamin C can help with COVID-19. / * But I think these statements implying *evidence of absence* are really about *absence of evidence*. NIH's National Center for Complementary and Integrative Health gets this key distinction right when it says "there is *not enough evidence to show whether* [vitamin C] is helpful." [emphasis added]. But * the dominant paradigm of evidence-based medicine considers only large-scale, long-term, well-funded clinical trials that are placebo-controlled and preferably double-blinded and randomized. Nearly all unpatentable over-the-counter supplements lack that kind of evidence, *and they always will*, because industry and government won't pay for it. * However, even NIH's and the *Times's* sole data source—the latest (2013) Cochrane Review of vitamin C and the common cold—doesn't match their paraphrases of it. What does it really say? *

The standard reference for rejecting vitamin C is widely misinterpreted

- That metastudy for *Cochrane Review* (a respected foundation of evidence-based medicine) reviewed 29 trial vitamin C vs. placebo comparisons of common-cold incidence (11,306 participants), 31 of duration, and 7 of therapeutic efficacy.
- 31 trials found regular vitamin C cut colds' duration 8%, and in children 14%, while also reducing severity; 1–2 g/d of vitamin C shortened children's colds by 18%. (NIH admits this, but deemphasizes its value.)
- 7 trials (3,249 episodes) found no consistent therapeutic value, but a large adult trial found 8 g of vitamin C at onset markedly shortened colds, and two trials of 5-day adult supplementation reported benefit; more trials are recommended.
- Authors concluded that failure to reduce *incidence* indicates "routine vitamin C supplementation is not justified" (except for people exposed to brief but severe physical exercise*)—yet (bold added) **"consistent effect of vitamin C on… duration and severity…and low cost and safety" may make it "worthwhile for common cold patients to test on an individual basis whether therapeutic vitamin C is beneficial for them.** Further therapeutic…[trials] are warranted."
- Does all that sound like evidence for "skip unproven supplements"? for "myth"?

*5 trials (*n*=598) found halved cold risk in such subjects, whose severe ascorbate depletion would make even the ¼–1 g/d dose useful. NIH interprets this as finding preventive value only for such subjects—not as suggesting that larger doses may help protect others.

** That metastudy—a study of studies previously done by others—reviewed 29 published clinical trials of whether vitamin C prevents colds, * 31 trials of whether regularly taking vitamin C helps cure colds, and * 7 trials of whether taking vitamin C when you get a cold can help cure it. * It found that a low dose of vitamin C could halve the risk of catching a cold for people doing brief but severe exercise, but the authors and NIH interpreted that as a finding of preventive value *only for those people*—not as a hint that larger doses might also help prevent colds in other people using larger doses. However, the metastudy *did* sensibly find that vitamin C consistently made colds milder and shorter, so its authors rightly said its safety and low cost could make it worth trying if you wish, and worth testing further. * Standard news media interpret all that to mean "skip unproven supplements" and that vitamin C's value is a "longstanding value" and a "myth." *

The standard reference for rejecting vitamin C rests on unsound clinical trials

- **Virtually all the doses were far too low.** Standard practice of orthomolecular physicians is 3–5+ g/d, more if it doesn't cause loose stool: i.e. titrate to bowel tolerance, or better, to "C Cleanse" test* (easy at home). Its data suggest today's need may be ~3× higher than 1970s need (more oxidativte stress). Need and tolerance also rise steeply with illness, so Hickey/Roberts' comment on Cochrane says prevention requires ≥2.5 g/d, treatment *10–200* g/d. Yet all preventive tests used ≤2 g/d, 7 used 2 g/d, 19 used 1 g/d, and 17 <1 g/d, down to 0.2 g/d. The only high-dose adult therapeutic trial (4 or 8 g, 1 g/h, at onset) did markedly shorten and mitigate colds, with higher dose more effective. Cochrane senior author Dr. H. Hemilä agrees** effects seen at 4–8 g/d, not at 3–4 may just reflect underdosing.
  - Basic science suggests vitamin C's preventive and therapeutic value are threshold effects—ascorbate saturation is needed to set low (virus-suppressing) redox potential, and to quench symptom-causing free radicals, so at sub-saturation doses, little clinical response occurs.
- **Probably all but one trial used far too infrequent dosing.**^ Only one frequency is stated, but almost all were apparently daily. Yet 1–2 oral doses a day don't increase plasma levels above background. Effective frequency is every ≤3 hours, or ≤1 h acutely, because half-life after big doses is very short (~0.5 to a few hours). Excreted ascorbate cannot donate electrons. Practitioners recommend *therapeutically* a ≥10-g loading dose + ≥2 g/hour.
- **Quality of vitamin C used is unstated or unknown.** Best results require **fully reduced, fully buffered *l*-ascorbate.** Mass-market vitamin C may be 2–4+× less effective, skewing the results. It's unclear what quality *any* Cochrane trial used (with possibly a few small exceptions).
- Even where the metastudy reports these three variables, **it rarely relates outcomes to how much or how often subjects took vitamin C—only whether they took any.**
- Little or no prevention would be expected under these conditions. But since low doses had "modest but consistent" therapeutic benefits, might higher-than-measured doses be protective too?

^ doi:10.1371/journal.pmed.0020307 * https://www.PERQUE.com/lifestyle/self-tests/ascorbate-cleanse/. **doi:10.3390/nu9040339 (2017)

** Careful reading reveals three fatal flaws in this Cochrane Review, all rooted in the underlying studies it analyzes. (I'll skip over some deeper questions about its basic methodology [www.youtube.com/watch?v=70eQKaZ5Bhs&feature=emb_title].) * First, the *doses* of vitamin C used are far too low—by even an order of magnitude—to show any effect. Even if the metastudy reported dose *vs.* response, the effects of low doses couldn't be extrapolated to therapeutic higher doses because the way vitamin C blocks cold symptoms and fights viral infections seems largely a threshold effect rather than linear. * Second, with perhaps one exception—the only trial whose dosing frequency was reported—all the trials' dosing was far too infrequent, leaving the subjects with very little vitamin C in their bodies most of the time. Ascorbate that has been excreted cannot donate or exchange electrons, so if you want vitamin C to be clinically effective, you need to take it spaced throughout the day, ideally every 3 hours or less (and every hour or less if you're sick) to sustain a titer high enough to quench the free radicals that cause disease symptoms and to create chemical conditions that suppress viruses. * Third, another potentially important variable—the *quality* of the vitamin C used—wasn't reported for *any* trial, but can vary considerably. One expert estimates that ~95% of the general-market vitamin C is a 50/50 synthetic mix of *l- and d*-ascorbate, of which the *d-* enantiomer is worse than useless; >50% is air-damaged (not made and shipped under inert gas); 100% is unprotected from air oxidation; and ~80% is unbuffered. Thus commodity vitamin C can readily be ~4x less effective than top-quality, and may have been used in most or all of the Cochrane trials.
* So these 64 trials scarcely report three critical variables, and their actual values, when you dig for them, make it scientifically invalid. * But the results do make one wonder: since modest doses clearly helped cure colds, might high doses help *prevent* colds? *

The standard reference for rejecting vitamin C is not optimally described

- This >70-year controversy—especially when double Nobelist Linus Pauling published vitamin-C-and-colds claims in the 1970s (graphed at https://doi.org/10.3390/nu9040339)—was poorly handled, e.g. some standard refutations' abstracts didn't match their evidence. Yet the science is old (Pfeiffer 1975, Dubos 1985, Cheraskin 1988) and solid.
- Orthomolecular practitioners claim preventive value from specific protocols* that the metastudy does not mention or test—**its authors state "none of the identified controlled trials directly test them"**—but many readers naturally and wrongly assume that the metastudy *did* test and refute them.
- In other words, trials dosing vitamin C in inadequate amount, frequency, and probably quality **are not evidence** that the claims of preventive value by practitioners using completely different protocols are untrue.
- Organizations as excellent as NIH and *NYT* should realize this.
- This absence of evidence is clearly explained in the 8 critical comments posted alongside the Cochrane Review. (On 10 Mar 2020 I submitted a 9th.)
- Such firmly embedded attitudes continue to block accurate reportage.
- I hope you can help break through these information barriers and the "inertia and prejudices against vitamin C" reported in 2017 by…the Cochrane Review's senior author.^

*≥8 g/d at ≤6h intervals prevents colds in most subjects (individual variation is high); very high doses (30–150 g/d at ≤1h intervals) can eliminate cold symptoms and may cure within hours; and dose/response is a threshold effect, with little or no subthreshold response.
^Hemilä, https://doi.org/10.3390/nu9040339—perhaps the best review of the vitamin-C-and-infections literature.

** That old controversy persists because practitioners of what Linus Pauling dubbed "orthomolecular medicine"—helping the body heal by giving it the right amounts of natural substances it needs—use * specific dosing protocols that they claim work very well, but the supposedly definitive Cochrane Review *was not meant to test and did not test* those protocols, as its authors explicitly agree. * The trials they *did* analyze used dosages that practitioners consider inadequate in size and frequency, and perhaps also in quality. Thus the results are *not* evidence that the practitioners' claims are wrong, as many readers assume. * They should understand this absence of evidence—all explained in the comments posted alongside the Cochrane Review. * I hope you'll read these materials yourself and seek accurate reportage. I'd suggest you start with the Review's senior author's excellent 2017 paper in *Nutrients*, called "Vitamin C and Infections" (https://doi.org/10.3390/nu9040339), where he details a long history of "inertia and prejudices" against this agent. Remember that *his* Cochrane Review is the study NIH and the *Times* rely upon to denigrate vitamin C! It's a fascinating and important story—especially with the emerging evidence that l-ascorbate may be the most effective known antiviral agent. *

Absent solid evidence, should we take oral vitamin C prophylactically?

- Vitamin C is generally safe: Cochrane trials reported no adverse effects, and oral doses orders of magnitude larger cause at worst transient diarrhea. Rare contraindications* don't apply to anyone else. CDC: "Vitamin C supplements appear safe, even at high doses."**
- Top-quality vitamin C (e.g. a PERQUE *PotentC* 1-g tabsule) costs just 26¢/g. (Commodity vitamin C is an order of magnitude lower-cost and less effective.)
- Vitamin C is ubiquitous (though not uniformly of high quality—mostly racemic synthetic).
- Empirical practice long considered 3–5+ g/d (~40–70 oranges/d) quite protective—but today that dose could be ~3× larger due to increased oxidative stress, times another ~4× if provided as partly oxidized, unbuffered *dl*-ascorbate that's common in the marketplace.
- This >50-y-old protective claim has never been refuted because it hasn't been tested.

1. The same official evidence that hasn't tested the protective claim *does* confirm *therapeutic* value, i.e. milder and briefer infections. This alone would valuably help slow the spread **even if preventive value were zero!**
2. Since the claimed preventive dose is safe, cheap, available, and easy, why not try it—***starting with healthcare/frontline personnel and high-risk groups?***
3. Amid a dangerous pandemic, isn't **not** trying this option riskier than trying it?
4. Regardless of vitamin C's value, **shouldn't we boost our immune and repair competences in all the *other*, uncontroversial, ways**—alongside anti-spread actions?

* E.g. diabetic ketoacidosis, glucose-6-phosphate dehydrogenase deficiency (G6PD), perhaps pregnant/breastfeeding. I omit hemachromatosis and oxalate kidneystones as invalid concerns with l-ascorbate. Do taper off high ascorbate dosage gradually, ≤3 g/d per day.
**https://wwwnc.cdc.gov/travel/yellowbook/2020/preparing-international-travelers/complementary-and-integrative-health-approaches

** As old dogmas collide with modern understanding, what should we do? * First, realize that *oral vitamin C is safe* (as Cochrane and NIH agree); the specific patients who shouldn't take it are well-known, and their restrictions don't apply to others. * *Vitamin C is cheap*, even in the best quality that gives the best results. It's * *easily available everywhere* (but do shop carefully). * Practitioners for a half-century found *3–5+ g/d*, equivalent to ~40–70 oranges a day, quite protective against viral infections, and * that claim has never been refuted, though modern oxidative stresses may have about tripled the dose. From these basic facts, I respectfully offer four inferences: * (1) The Cochrane Review *did* find that vitamin C (even in low and infrequent doses) made colds shorter and milder, so taking it—especially more, and more often—should valuably help slow the spread of viral infections *even if preventive value were zero.* * (2) Since this antiviral option is safe, cheap, available, and easy, shouldn't we just do it, especially for the healthcare and other frontliners and the specific population groups most at risk? * (3) Amid a dangerous pandemic, are you more at risk from taking enough high-quality vitamin C that it may help prevent your getting sick (especially in serious ways) and is proven to help cure you if you do get sick, or are you more at risk from *not* taking it because those high doses haven't yet had the kind of formal experimental test they deserve, and some opinion leaders misinterpret this as having proven they won't work? * (4) Even if vitamin C were utterly worthless, shouldn't those frontliners, high-riskers, and all the rest of us still adopt the *non*-supplement ways to take better care of ourselves (slide 5) and thus boost our immune competence uncontroversially? That is, shouldn't our public-health strategy give comparable emphasis to not catching the bug *and* to making any infections shorter, milder, and less likely? *

Potential good news: acute intravenous ascorbate is increasingly used

- Since Marik 2018 (doi:10.1016/j.pharmthera.2018.04.007), the literature has reported wide and successful use of large (tens of grams) *intravenous l*-ascorbate therapy for sepsis and septic shock. (Orthomolecular physicians have done so since the late 1940s*—even as much as 300 g.)
- This even worked for *recurrent* Acute Respiratory Distress Syndrome caused by a genetic disease (doi:10.1155/2016/8560871). ARDS is a life-threatening condition common in severe COVID-19 infections, typically due to a cytokine storm**. So clearly vitamin C is a clinically relevant agent.
- A new review (doi:10.1080/14787210.2020.1706483) says: "Anecdotally, we have treated about a dozen patients with **life-threatening respiratory failure due to influenza A infection** with [IV ascorbate + thiamine]; these patients demonstrated a **rapid improvement**." It calls urgently for well-designed clinical trials of vitamin C adjunctive therapy in serious viral infections. I suggest **hospitals stock up now on IV ascorbate** for acute care: it can reduce the need for and duration of support by ventilators, on which the US is >10× short, so **we need a huge number of "virtual ventilators" now**.
- Shanghai Government Medical Association and a top Xi'an teaching hospital recommend this†. At least three clinical trials are underway (the first at clinicaltrials.gov/ct2/show/NCT04264533). In Wuhan, 24 g/d of IV ascorbate was found safe and effective in severe cases. Fifty tons of vitamin C were reportedly shipped to Wuhan a few weeks ago.
- Prophylactic use uses similar modes of action. Hemilä (2017 op. cit.): ""Three controlled trials found that **vitamin C prevented pneumonia**. Two controlled trials found a **treatment benefit of vitamin C for pneumonia patients**." Preventive doses seem to reduce progression to serious/critical cases, ~2 g/d can **shorten ICU stays 8.6%**^, and just 1–6 g/d **shortens average ventilator duration 25%.^^**

*www.orthomolecular.org/resources/omns/v16n09.shmtl **Summary at www.orthomolecular.org/resources/omns/v16n11.shtml, 16 Feb 2020.
† https://mp.weixin.qq.com/s/bF2YhJKiOfe1yimBc4XwOA; http://2yuan.xjtu.edu.cn/Html/News/Articles/21774.html; both in Chinese.
^ https://www.mdpi.com/2072-6643/11/4/708 ^^https://jintensivecare.biomedcentral.com/articles/10.1186/s40560-020-0432-y

** Meanwhile, there's exciting news from the intensive-care world, confirming vitamin C's value in this pandemic. Vitamin C administered intravenously (a route severalfold more effective than oral) in tens-of-grams doses, as some practitioners have done for decades, has lately been safe and effective in treating septic shock and single or * even recurrent Acute Respiratory Distress Syndrome—two related life-threatening conditions, the latter common in severe COVID-19 infections. * Respected US literature, like this 2020 paper from the *Expert Review of Anti-infective Therapy*, is starting to acknowledge this, noting rapid improvement in ARDS patients with influenza A, and calling urgently for proper trials of this use of vitamin C in serious viral infections. * Three such trials are already underway in China, where 24 g/d IV proved safe and effective in COVID-19 pneumonias. The Shanghai Government Medical Association officially endorsed this therapy on 1 March, and 50 tons of vitamin C were shipped to Wuhan a few weeks ago. * The circumstances of use are very different than in oral supplementation, but the underlying modes of action are similar. Safe oral dosing in the claimed preventive range could be of special value for high-risk groups in reducing the likelihood and severity of serious and critical cases, reducing progres-sion to the critical stage requiring heroic IV doses, and effectively acting as "virtual ventilators" at a time when actual ventilators could become scarce, costing lives. For Granny in Gainesville, there's encouraging evidence that vitamin C can prevent and help treat pneumonia [^ ref on slide 10, pp 16–18] and can make serious pneumonias rarer. Just a few grams a day can shorten ICU stays 8.6% and shorten average ventilator duration by 25% (for patients needing ventilation for more than ten hours). That's like having one-third more ventilators: the ventilator-hours' capacity we have is equivalent to 4/3 as many ventilators used 3/4 as many hours. Vitamin C is more than a thousand times cheaper per day than an ICU. *

Might other often-dismissed supplements also be valuable? One example

- Five layers of dendritic cells provide the body's immune and repair functions. Those cells' metabolism requires polyphenolics such as the flavonoids **quercetin dihydrate** and oligomeric procyanthocyanidins (**OPC**)—in essence, concentrated dark-green leafies. A great-ape diet provides plenty, but a standard western diet has just a few percent of what our dendritic cells need, causing widespread chronic repair deficit.
- Concentrated high-quality and -availability quercetin+OPC supplement anecdotally has remarkable anti-inflammatory and repair-and-immune-boosting activity. I've taken 8 g/d (maintenance) to 8 g/waking hour (acute) of PERQUE *Repair Guard* for >10 y (mainly for knees), plus ~13 g/d of vitamin C and some other supplements. It's extremely rare for me to get sick at 72, despite extensive global travel and 10 y of childhood agammaglobulinemia. If it's placebo effect, I'll gladly take it. I know the plural of "anecdote" is not "evidence" and *n=1* is not persuasive, but I do notice anecdotes, and declare this one as informing my bias.

** There's more: remember vitamin C was just one of at least *six* supplements listed on slide 6. Here's another on which there's limited clinical-trial evidence—again, because industry and government won't pay for it—but remarkable clinical experience. Our repair and immune functions are delivered by five layers of dendritic cells. They need specific nutrients from dark-green leafies like great apes eat. We get so little of those polyphenolic molecules in our western diets that most of us have chronic repair deficit, causing symptoms like sunburn. But taking concentrated dark-green leafies (supplements with high-quality quercetin dihydrate and OPC—two powerful antioxidant flavonoids) * yields, anecdotally, remarkable repair, immune, and anti-inflammatory properties, including severalfold-faster-than-expected healing in a dozen fracture patients in my own experience. I credit this supplement, Vitamin C, and others with keeping me healthy with virtual perfection at 72 even though I travel hard in >70 countries and was born with no measurable gammaglobulin, causing ten years of continuous respiratory infections until this was figured out. If my health ever since is a placebo effect, I'd like more of that. Of course I realize that the plural of "anecdote" is not "evidence," and a sample size of one isn't convincing, but I do pay attention to anecdotes, and this one informs my personal bias. *

An easy way to do no harm, potentially do much good, and buy precious time

- **Enhancing community immune competence** appears sound, timely, and worth immediate consideration.
- All the **uncontroversial** ways to improve immune competence in the general population (slide 5) should be immediately publicized now, including by CDC and WHO. Public ignorance is not bliss and is not safe.
- Orthodox literature supports adding **vitamin D** (at doctors' option) and **zinc lozenges** (properly used at sore-throat onset—supine pharyngeal drizzle, not systemic).
- Despite ambiguous clinical-trial evidence because practitioners' clinical hypothesis was not actually tested, empirical evidence is strong that 3–5+ g/d of high-quality **vitamin C** (preferably more, as much as won't cause loose stool), divided throughout the day, seems safe, fast, scaleable, cheap, and complementary to the valuable standard preventive actions. To the extent this potential mitigator works as practitioners say, it could offer huge leverage by reducing infection risk, duration, and severity for healthcare workers, other frontline personnel, & other high-riskers, and by stretching healthcare resources through reduced incidence and severity.
- These approaches will become even more vital **if no effective vaccine emerges**.
- **Not** doing all these things now may in hindsight look like negligence.

So pulling all these points together: * we should tell the rest of the story and start urgently enhancing community immune competence, at least by * the universally accepted means, and also by * suggesting people may wish to try vitamin D (not to excess, and based on bloodwork), properly used zinc lozenges at onset, and yes, high-quality * vitamin C—3–5 g/d (more if tolerated), divided throughout the day. All these actions look safe, fast, scaleable, cheap, and complementary to the valuable standard preventive actions. Immune-boosting actions definitely do not *replace* isolation, social distancing, and handwashing; all those remain sound and essential. But *adding* immune-boosting actions to the existing official advice could do no harm, potentially save a great many lives, and buy precious time, especially to avoid catastrophic overwhelm of our healthcare system. Next year, * when we may well learn a specific vaccine isn't feasible, so it's all between the evolving virus and your immune competence, * I'd like to look back on how adding "the rest of the story" to the initial slate of responses helped cut this virus's US death toll from potentially a million-plus to tens of thousands, like a bad flu year. I don't want to peer out of the social wreckage to say, "I wish we'd figured out how to persuade people to try this in time." *

Primum non nocere

“When harm is underway,
proceed urgently to learn how to stop it,
and act urgently on the learning.”

— Don Berwick MD MPP (2007)
www.youtube.com/watch?v=70eQKaZ5Bhs&feature=emb_title

The first rule of medicine is *primum non nocere*—first, do no harm. Don Berwick (the Harvard Med doc who later led Medicare and Medicaid), when we co-keynoted 13 years ago the annual meeting of his Institute for Healthcare Improvement, paraphased that prime directive as “When harm is underway, proceed urgently to learn how to stop it, and act urgently on the learning.”

Don also said we need “not just no, wait, but, show us, but also—louder—yes, we can, try, learn…and always thank you.”

So I thank you for your kind attention, correction, improvement, and action. *

Appendix: Three little leftover questions about COVID-19

- James Robb MD FACP, a pioneer UCSD coronavirus researcher since the 1970s, recommends zinc lozenges*, several times a day starting at earliest onset of any cold-like symptoms, *and dissolved slowly into the back of your throat and nasopharynx* (best while lying down), as they're an effective topical virucide. Not the same as swallowing pills. Dr. Harri Hemilä (senior author of the Cochrane Review of Vitamin C) strongly confirms zinc's value**. Why does CDC ignore it and *NYT* denigrate it?
- They both say the elderly are at special risk. Does that finding factor out covariant comorbidities common in the elderly (e.g. unmanaged cardio-vascular disease, diabetes, or hypertension, lung damage from smok-ing, immune suppression)? If not, **how do we know that age is a risk?**
- Flu shots can reduce your risk of flu, unburdening healthcare resources. Up-to-date measles shots avoid that hypercontagious disease, which can wipe out "immunity memory" from past immunizations and infections. Shouldn't these preventive actions be mentioned too?

*Use sparingly, or can cause nausea; can inactivate sense of taste for 1–2 and dental anesthetics for ≤3 d. Do *not* use zinc in the nose.
**https://www.mv.helsinki.fi/home/hemila/Zinc.htm