Open-source “pandemic ventilator” (instructables.com)

147 points by ericb 13 days ago | hide | past | web | favorite | 110 comments

add comment

7a1c9427 13 days ago [-]

The naiveté being expressed in the comments here and as the premise behind the ventilator is astounding. I though I would share some information to put things in perspective:

- If you are unwell enough to need a ventilator then the ventilator itself is going to the least of your worries. You will need the drugs and expertise to care for you. The current respiratory illnesses going around aren’t like polio and the iron lungs where all you need is help breathing.

- If you can sort the above to have any hope of survival you need a “modern” ventilator that can operate in way that this simple homebrew device is physically not capable of offering. Most of the improvement in caring for people with ARDS is based upon careful and tight control of ventilatory parameters to prevent secondary lung injury.

- Modern ventilators have a price tag of if you have to ask you can’t afford it.

So in summary this is a nice build but serves no practical purpose.

reply

prostheticvamp 13 days ago [-]

This is correct.

Particularly the “if you are unwell enough to need the vent, the vent is the least of Your worries.”

The vent keeps you oxygenating while we address the (usually multiple, overlapping and interacting) severe issues that led to you needing the vent. This is ICU-level care. A vent without an ICU doc and appropriate medications (and ideally a resp tech and a nurse) might as well be an origami crane.

Hospitals will run out of one those other things, on average, before they run out of vents.

reply

all_blue_chucks 13 days ago [-]

In Wuhan they ran out of hospital capacity and sent people home. People bought vents to administer to their relatives at home without medical supervision.

You need to dispose yourself of the false assumption that people who need vets would even be able to get through the door at an ICU during a serious pandemic.

reply

cycrutchfield 13 days ago [-]

I hope those folks, well-intentioned as they may have been, did not deprive actual hospitals from getting the equipment that they needed by doing this.

reply

iflp 13 days ago [-]

Could you please provide the reference? The ventilation procedure is very difficult and dangerous to carry out, and I've seen people confusing oxygen

mask and related devices (as treatment for mild syndromes) with ventilators.

reply

bryanrasmussen 13 days ago [-]

considering the cost of ventilators I doubt that people in Wuhan were using them in any numbers likely to be noted, thus yes, oxygen masks and related devices most probably.

reply

joe_the_user 13 days ago [-]

I expected the answer that amateur solutions won't work from medical professionals and expected that to be correct.

But obviously, the question many people are concerned with now is "can't we triangulate?" When you have an epidemic threatened to overwhelm medical facilities and we know the physical construction of some these devices isn't by itself that complex, isn't there a way a more organized and knowledgeable DIY approach could work when the naive, uninformed approach certainly wouldn't?

reply

joe_the_user 12 days ago [-]

On the subject:

"WHO urges stocking up on ventilators to combat coronavirus"

https://www.channelnewsasia.com/news/world/who-urges-stockin...

reply

jfim 13 days ago [-]

Thanks for chiming in.

If I understand what you're saying correctly, you're saying that in the case where one would be so sick as to require a ventilator, they'd be in a situation where the ventilator only buys more time before the condition worsens, but doesn't actually address the root cause of the problem. As such, even if someone were to find a hospital-grade ventilator that fell off the back of a truck and managed to properly use it, the non-ventilator care is what makes the difference in outcome, not the ventilator itself.

Is that correct?

reply

prostheticvamp 13 days ago [-]

Not quite. The vent process itself requires careful management to provide net benefit (eg, controlling the level of sedation, avoiding secondary lung injury).

So while the non-vent care is what makes the difference, improper use of a hospital grade vent is more likely to do harm than good. Eg, Vents frequently clog. It requires a little bit of clinical experience to recognize that as what’s happening, and intervene appropriately. It’s not a complicated thing, and anyone that’s worked the ICU for a bit can recognize and handle it, but it would be a killer in the hands of a layman, and it’s only one out of a hundred issues.

Additionally, I’d hesitate to describe it as buying time, because that implies a linear sequence. Let’s say you have condition X that implies oxygenation and blood perfusion. Vent manages oxygenation while I work on maintaining perfusion and the underlying X, but if all I have is the vent, the patient will still die from lack of perfusion. The vent didn’t buy any additional time, it just closed off one route of death temporarily.

When a patient needs a vent, it’s very rare that the vent is the only route to death that is being proceeded along.

This was pretty stream of consciousness, but I’m typing in the bathroom, so ... sorry if it’s a bit of a mess.

reply

malandrew 13 days ago [-]

How do you maintain perfusion?

reply

prostheticvamp 13 days ago [-]

It depends on the precise mechanism of failure, but generally a combination of fluids of various concentrations and extravasation characteristics, and drugs that either cause the constriction of blood vessels, or increased heart pumping strength, or both (these often pop up in popular media as “pressors”).

reply

mike_d 13 days ago [-]

> a hospital-grade ventilator that fell off the back of a truck and managed to properly use it

Step 1 is inserting an ET tube in the patients mouth and down past the vocal cords without killing them in the process. So hope your truck also drops a laryngoscope.

Step 2 is picking the 6-7 parameters on the vent so you don't burst the lungs like an overfilled balloon or suffocate the patient because their throat is now sealed and you aren't providing enough O2. So steal a doctor from the truck too.

reply

catblast 13 days ago [-]

Theres all that and then the fact that the ventilator itself can make you sick. The number of patients (among hundreds) I have known on long term ventilator support that didn’t have a case of pneumonia in five years I can count on one finger.

Not to mention ventilators will damage your lungs if not correctly configured.

reply

toohotatopic 13 days ago [-]

Can you elaborate on what else is done to treat those patients? I was under the assumption that the pandemic situation is caused by a virus and that not much can be done against a virus besides waiting for the body to heal itself. (Which is not entirely true, since AIDS can be treated nowadays.)

reply

prostheticvamp 13 days ago [-]

You’re correct there’s not a lot to be done for the virus itself - in that situation, care tends to become about protecting the various organs suffering in the process, to get the patient through it.

For example: a patient presents with acute respiratory distress and sepsis due to the flu, covid, whatever. The fluid in the lungs will be creating a burden on the heart; the general inflammation will be pissing off everything, including making blood vessels both leaky and dilated.

The burdened heart is now prone to being overtaxed. With leaky vessels, it’s also prone to being under supplied. And oxygen isn’t coming across the lungs well. A mismatch between its blood/oxygen supply and demands causes what’s called a demand ischemia - you can think of it as a kind of heart attack. This further weakens the heart.

This shortage of both supplied blood, and oxygen in the blood, plus systemic inflammation, can hit every other organ: kidney, liver, gut, etc.

This is where you can start to see some shock liver kick in. Which means one of our core mechanisms for metabolizing drugs (and everything else) is telling us to fuck off.

The same shock effect can hit kidneys. Reduced perfusion not only hurts kidneys, but means waste dumping into urine is being decreased, or not happening. We try to prop up kidney function. We also add fluids to try and increase perfusion (but if we have had an ischemia, the same bulk of fluid that is needed to maintain perfusion pressure can also act as a burden on a weakened heart.)

If the gut goes significantly ischemic, it can die. Even if it doesn’t die, local inflammation and reduced food intake can make it leaky. You’re not necessarily seeding bacteria into the blood that way (studies of pancreatitis w associated sepsis suggest that’s not a major contributor), but the gut associated lymphoid tissue is definitely going to be kicking into high gear and promoting our inflammation storm even more.

So, we try to carefully maintain perfusion, which involves monitoring and calibrating our support for heart, kidney, lung, etc. in an ongoing and dynamic fashion. And not uncommonly, besting down infections that develop along the way, because a bunch of plastic in the body is a badness.

I don’t work much in the ICU, so if I’ve misrepresented something and we have an intensivist on hand, I defer to them.

reply

toohotatopic 12 days ago [-]

Thanks a lot. That's a great explanation.

reply

microcolonel 13 days ago [-]

While a bad ventilator in the wrong situation may be worse than no ventilator, sometimes no ventilator means you are dead.

It is highly unlikely that anyone will build this and attempt to treat a patient at home without reading anything.

> Modern ventilators have a price tag of if you have to ask you can’t afford it.

That seems like an excellent reason for more people to look in to and think about how to reduce cost of a useful ventilator for emergency use, as an essential (but not sufficient) part of supporting large numbers of concurrent patients suffering ARDS.

Yes, if you are hypoxemic, your brain's going to be telling you to hyperventilate, which means they'll have to administer drugs to prevent you from fighting the vent. Yes, at present, there is no automated system that would be able to support a patient in any meaningful way.

However, it is worth thinking about.

reply

prostheticvamp 13 days ago [-]

> It is highly unlikely that anyone will build this and attempt to treat a patient at home without reading anything.

I’m not going to pretend that 0% of the human population could manage a ventilated patient with nothing but the appropriate texts, but it’s pretty damn close to 0%. Hell, a fresh third year med student would almost certainly kill a patient in that situation, and they’re at least supposed to understand the relevant physiology and drugs.

The vent is a tool for adjusting a couple of physiologic parameters, in the context of what is usually severe and complicated disease. It doesn’t manage anything by itself, and it’s not a RTFM situation.

reply

_Microft 13 days ago [-]

It is not hypoxemia that is detected, the regulation of breathing depends on the level of carbon dioxide in the blood instead.

reply

nradov 13 days ago [-]

There is also a hypoxic breathing drive but it is weaker than the hypercapnic drive.

reply

bryanrasmussen 13 days ago [-]

>It is highly unlikely that anyone will build this and attempt to treat a patient at home without reading anything

unless if they had read some stuff about what was required in treatment they decided making a ventilator was worthless, which is basically what people knowledgeable about treating patients are suggesting.

reply

Johnny555 13 days ago [-]

It is highly unlikely that anyone will build this and attempt to treat a patient at home without reading anything.

Citation needed.

reply

Cpoll 13 days ago [-]

> - Modern ventilators have a price tag of if you have to ask you can’t afford it.

Not sure about the efficacy, but I was reminded of this discussion ("A doctor in Bangladesh has found a simple way to treat infant pneumonia"): https://news.ycombinator.com/item?id=17945071

reply

benmaraschino 13 days ago [-]

You the nail right on the head. Especially regarding VALI. Personally, I’d also be worried about any residues in the system (e.g. lubricants, grease, etc.) being blown into your lungs. That’d be an excellent recipe for a hellish aspiration pneumonia on top of the underlying illness.

reply

sowbug 13 days ago [-]

Not asking about DIY, but since you are more knowledgeable about medicine than I, you might know. Dialysis exists. Could a variant of a dialysis machine oxygenate blood and scrub it of carbon dioxide to treat an ARDS patient? Is the main problem that dialysis can't move a high enough volume of blood to keep a person alive?

reply

dillondoyle 13 days ago [-]

Isn't that basically what ECMO is? like a super intense way to do all the things we need to live via our blood outside the body

reply

iancmceachern 13 days ago [-]

Yes, it's also what a "heart lung machine" is. They even use oxygenators that are very similar in construction to dialyzers used in dialysis.

reply

DoreenMichele 13 days ago [-]

https://www.rtmagazine.com/disorders-diseases/chronic-pulmon...

reply

rscho 13 days ago [-]

Well, TBH we don't really know how to ventilate ARDS. Doing so will likely require new paradigms in ventilatory tech.

So yeah, useless but fun!

reply

Confiks 13 days ago [-]

Here [1] is another interesting low-cost version of ventilator. It's an immersion two-phase continuous positive airway pressure (CPAP) device, of which all the parts are printable. The patient still needs to be able to initiate breaths themselves, but it will cost a lot less energy to breath.

Combine it with a (admittedly lot harder to make) homemade pressure swing adsorbtion system that delivers high-oxygen air, using zeolite sieves and alternating pressure [2].

[1] https://www.youtube.com/watch?v=CHiRTMQCf1Y

[2] https://www.youtube.com/watch?v=ylj4oOnlIY0

reply

Gravityloss 13 days ago [-]

Not a medical professional but the CPAP route sounds more promising to me. Simpler, less risk.

What about just oxygen bottles or oxygen enrichment? They have their own dangers though.

reply

kortex 13 days ago [-]

I would imagine in a situation where you need ersatz CPAP, bottled oxygen is harder to come by and/or less affordable.

PSA oxygen generators are simple to construct and provide continuous oxygen as long as you power them.

reply

zelienople 13 days ago [-]

In the initial studies out of Wuhan, about 15% of Covid-19 patients required critical care. These patients were treated with a ventilator, antiviral medications, and the support of an ICU. The mortality rate was about 2-3%.

This scenario does not scale very well in a pandemic because there are simply not enough resources to provide this level of care to those who need it.

There are about 5000 ventilators in Canada, for example, meaning that the country can effectively treat, at most, about 33,000 cases, assuming that the 15% ratio of total sick patients to those requiring critical care holds true.

The mortality figures that we have so far are based upon everyone who needs it receiving critical care. As the pandemic scales, the mortality figures could easily reach 15% as the number of sick greatly exceeds the capacity to treat them.

This project shows, therefore, that someone understands the real problem of Covid-19 and is attempting to solve it.

I'll take a plywood ventilator over no ventilator any day of the week, even without the other resources of an ICU.

I suspect a jet ventilator would be easier to build and more effective under the circumstances, so maybe that should be version 2.

reply

Delariva 13 days ago [-]

While well intentioned, I really don’t think this should be built by anyone for use on an actual patient. As mentioned in other posts, mechanical ventilation is only part of “life support” with a typical ICU admission for ARDS requiring: establishing peripheral IVs, central venous line (giant IV in neck to heart placed under sterile conditions), intubation (Which requires expertise and

advanced equipment), oxygen (lots in terms of liters), medications (inotropes, sedatives, paralytics, nutritional support, bronchodilators, etc.) urine/foley catheter, the ability to suction the airway, nasogastric tube, bedside monitoring (arterial line, capnography, etc) potentially chest tube, dedicated bedside staff and access to X-rays and CT, blood work (particularly Arterial blood gas analysis for mech vent) to guide process, specialists for consults and this doesn’t include what else is needed when other systems fails (as is this case in ARDS: kidneys can fail which needs dialysis). Also, mechanical ventilation needs heat and humidification (requiring about 1L or sterile water every 12-24 hours) so you don’t jam up the airways with a mucus plug; so you need a temperature probe on the vent circuit as well.

Also, mechanical ventilation is an aerosol generating medical procedure and even with the proper filters can still expose people in the surrounding meter or so to a virus.

There’s also a great little unit that was used in Vietnam war called the Bird after the inventor - simple and clever and should be able to be cheaply manufactured or even potentially DIY but I think it required a high pressure gas source to drive the tidal volume.

reply

Diederich 3 days ago [-]

Thanks for a detailed, well considered response.

> intubation

Do you think a laryngeal mask airway would useful in these kinds of situations?

reply

DoreenMichele 13 days ago [-]

I get that people are scared and trying to reassure themselves. This is really not the way to go.

I don't know how to foster some kind of constructive discussion of preventive best practices or whatever, but medical devices that aren't cleaned properly and kept sterile cause horrifying and deadly infections regularly. This even happens in hospital settings.

This article doesn't even seem to be bothering to address the need to disinfect everything. With lung issues, that's a not unimportant detail.

reply

lukevp 13 days ago [-]

This is maybe unrelated, but is there a diy version of a mask for filtering air? What I want is a full face mask with filtered air for working on cars, around solvents and paints, and such, but the masks usually require the force of your own lungs to pull the air through the filter and through a 1 way valve when you exhale. I want something battery powered that does the air filtering. What am I looking for and how much does this cost? And would something like this be usable for what I had envisioned when I read “pandemic ventilator” which would be like something you could wear while you were out and about and it would filter everything you’re breathing.

reply

amluto 13 days ago [-]

What you want is called PAPR.

edit: Avoiding the extra breathing effort is only part of the benefit. Respirators generally let a lot more pollutants in through leakage than through actual failure to capture them because it’s very hard to make a good seal around your face. A *powered* respirator can keep the internal pressure neutral or slightly positive, reducing the tendency for anything to leak in around the mask.

reply

fao_ 13 days ago [-]

Is the battery for some kind of fan that pulls in air? Presumably any kind of fan would make it difficult to extract the air output properly. You should focus on HEPA compliant masks that make it easier to filter out things, like the Respro series -- however those are not confirmed for use to extract solvents and paints, so that might be worse than no option at all because you could believe that you are protected and actually the mask does not protect you.

reply

viklove 13 days ago [-]

What would the battery be for?

reply

lukevp 13 days ago [-]

To power some type of air pressurization system so that it’s not my lungs that are pressurizing the air, this is because filtering the air requires additional pressure to force the air through the filter.

reply

Altjira 3 days ago [-]

I live in Vietnam. They do not have anywhere near the capacity needed to deal with ventilating. In HCM with a population of 9 million the largest hospital, Cho Ray, has 1000 beds ready but only 200 intensive, and 20 ventilators. Even fewer ECMO kits. Its one of the best equipped hospitals in the country. If things get bad, thousands will be sent home, thousands will die. Currently we are working on ways to repurpose industrial bottles and work with local gas and liquid oxygen manufacturers to come up with stop gap solutions to get oxygen to several thousand people at once, across the whole city, using existing propane gas distribution systems and grab app for monitoring and delivery. This is our ONLY option. For those pointing out how dangerous homemade ventilators and oxy kits can be, assume that WE KNOW that already, and that we wouldnt be looking at this unless it looked like there being no other option. We have under 700 large hospitals, but over 35,000 local clinics, many of which are run by local doctors with training and their own oxygen gear. We dont need them to be perfect, we dont need them to last forever, we just need them to work. If they save more than they harm, when people without them would die anyway, thats a meaningful impact. And yes, Viet doctors and government will use WHATEVER they need to get sh*t done and save lives.

reply

Cass 13 days ago [-]

If it comes to that, you can also share a conventional ventilator between two people. It's an ugly hack, because you have to use the same settings on both patients, so it doesn't allow for the sort of precise control you want if you're managing ARDS, but probably still a better solution than using a home-made ventilator.

It was successfully used when the ER ran out of ventilators in the wake of the Vegas shooting[1], but is probably better used in the sort of emergency where you just need to win a few hours' time than a sustained crisis.

1: https://epmonthly.com/article/not-heroes-wear-capes-one-las-...

reply

sitkack 13 days ago [-]

The number one issue with ventilators is bacteria and second is if they fail you die.

This absolutely the measure of last resort, but as the pandemic spreads there will be ventilator shortages and people that don’t have to die will die.

reply

kortex 13 days ago [-]

Wow, some of the comments/downvotes here are astounding, especially for a group of people priding themselves on problem solving and FOSS.

Obviously, a plywood vent isn't hygenic. But R&D isn't a zero to one jump, you gotta start somewhere. Often it's that first spark of "wait this is something that needn't be only the domain of hospital gear companies" to inspire others to work on the problem.

Sure, a vent alone is probably not gonna improve your chance of living without the right care, but if there was a set of condensed instructions and WHO essential meds, yeah, maybe you have a shot.

This is also more about developing countries / rolling pandemics / CME-Carrington event than cov19 alone. Tell me, when was the last time you saw a panic in a trace/log to the effect of, "This should never occur." ? No one wants to be in the situation to need backups. This is part of a backup plan.

The defeatism in this thread already makes me want to go and improve the design. For one, you can get pneumatic valves which take the place of 2 or maybe even 3 of the valves on the machine.

reply

greesil 13 days ago [-]

I was thinking that with the shortage of antiviral masks in the consumer space, if there was a way to diy one. Extra points if it involves a 3d printer.

reply

JshWright 13 days ago [-]

Masks are not for keeping healthy people safe from pathogens. They are for keeping sick people from spreading virus laden droplets when they cough/sneeze.

A mask that's capable of keeping a virus out is a a) much more expensive than a typical surgical mask, b) easy to wear improperly, negating its usefulness, and c) only good for a limited time before needing to be thrown out.

reply

Johnny555 13 days ago [-]

And inhalation isn't the only way to get infected -- any mucous membrane (including the eyes) is a possible infection route. The only real protection is a full hazmat suit with a full face shield. And you need to know how to take it off without infecting yourself.

The best way to protect yourself from the illness is to stay away from other infected people, not wear some home made protective gear that you're probably not going to replace often enough or handle and dispose of properly after you take it off.

reply

mike_d 13 days ago [-]

> Masks are not for keeping healthy people safe from pathogens

All the doctors and nurses having to wear masks will be so relieved to hear this.

But seriously the advice of not wearing N95 masks when you are healthy is not because they are ineffective, but because they are trying to discourage hoarding. Even current CDC recommendations for healthcare workers suggest N95 masks for only patient intake and direct care, with all others wearing surgical masks to help protect the supply of N95s.

reply

JshWright 13 days ago [-]

This discussion wasn't targeted at healthcare workers, and I never said N95 masks weren't effective (when worn properly). N95's are the type of mask I'm referring to in the second half of my comment. Worn properly, they are an essential piece of PPE.

The difference is, healthcare workers are trained in the use of N95 masks, undergo annual fit testing, etc.

reply

mike_d 12 days ago [-]

You might be interested in this [1] training video showing that proper use of N95 masks is basically how people put them on.

Additionally - this [2] new search shows that if 80% of uninfected persons wore a mask for a few days, the pandemic would be over.

1. https://www.youtube.com/watch?v=zoxpvDVo_NI

2. https://www.ncbi.nlm.nih.gov/pubmed/30229968.

reply

maccard 13 days ago [-]

Health workers are likely aware that those protections are for the safety of the people they're treating, not for themselved

reply

greesil 13 days ago [-]

Maybe I just want one so I don't cough on family members. They are effective for this use case.

reply

JshWright 13 days ago [-]

Yes, that's exact the use case I'm suggesting...

reply

arcticbull 13 days ago [-]

Very cool project, and a fun article, though I can't help feel like this thing is more likely to kill you than nCoV-19. It's got a mortality rate of 0.7% (same order of magnitude as the garden variety flu) and I'm betting there's a much more than 0.7% chance this thing blows your lungs clean out haha.

reply

confeit 13 days ago [-]

It does not favorably compare to SARS-CoV-2003.

15%-25% have severe symptoms. 5%+ critical. Of the first 100 cohorts in Wuhan with critical symptoms, 49 died (2.5% mortality rate). Patient-1 in Italy is a 38-year-old marathon runner. He is unconscious, intubated, and fighting for life. Doctors say they need "luck".

Doctors and nurses are dying from this. They did not die from treating patients with the garden variety flu. Conservative estimates put the mortality rate at 2.3%, with only room to grow as people die years later.

If you have severe symptoms, but are send home to self-quarantine, because the hospitals are over capacity, death rate is estimated at 80%-85%.

https://jamanetwork.com/journals/jama/fullarticle/2762130

reply

nonbirithm 13 days ago [-]

Exactly. The current mortality rate is predicated on the fact that people with confirmed cases are getting complete medical care. Instead it would be clearer if this were indicated as a given only because of the circumstance that there are still enough hospital beds for everyone being infected.

The more important factor is the hospitalization rate. If enough people become sick and hospitals become overloaded with patients they cannot treat to recovery faster than the virus spreads, there would be no choice but to send them elsewhere and the mortality rate would drastically increase. There are only so many professional medical staff but the virus has no limits on the amount of people it can spread to, and it sounds like the amount of continually attended medical care necessary for complete recovery is substantial.

Combine that with the fact that licensed virologists are giving estimates of 40-70% of the *global population* becoming infected, and I'm beginning to question why nobody in my immediate circle is taking this as an imminent and serious threat to their health.

reply

eveningcoffee 13 days ago [-]

I think the reason why people dismiss this is that they are either stupid (including intentional ignorance) or scared (to even think about this).

I think that there is also huge amount misinformation circulating initiated by the people who should know better (especially should know better when to not give wrong answer then they actually have no idea).

reply

arcticbull 11 days ago [-]

Or because the data doesn’t bear out the panic. South Korean CFR is 0.2% and over 55% asymptomatic means it may be less fatal than the H1N1 influenza A virus. People are hoarding tinned food over something as severe as the common flu. Yeah another virus isn’t optimal but it’s by no means the apocalypse.

reply

confeit 11 days ago [-]

For countries with outbreaks:

- Fully educate the general public on the seriousness of COVID-19 and their role in preventing its spread;

For the public:

- Recognize that COVID-19 is a new and concerning disease, but that outbreaks can managed with the right response and that the vast majority of infected people will recover;

So the WHO tells you it's serious and concerning. Not that it is as severe as the common flu. Did we see proper management of outbreaks in the West? Well...

> "The incompetence has really exceeded what anyone would expect with the C.D.C.," said Dr. Michael Mina, an epidemiologist at Harvard University.

About hoarding canned foods:

> We're asking folks in every sector, as well as people within their families, to start planning for this, because as we've seen from the recent countries that have had community spread, when it hit in those countries, it has moved quite rapidly

> Dr. Theresa Tam: Prepare ... Some of those steps include stocking up on needed prescriptions ahead of time so there is no need to do so during a possible pandemic. She also recommended people stock up on non-perishable food.

Both Canada and US CDC have told people to prepare, including stocking up on non-perishable food. What's the worst thing that could happen when this turns out to be a tempest in a teacup? You eat from your pantry the next few months, or you donate it to a homeless shelter. What's the worst thing that could happen, when you don't prepare, and this turns into quarantine-levels bad? You'll have to live with the guilt of ridiculing people for preparing for one. The other bad things are unspeakable.

The data you gather may not bear out the panic, but can you think of a reason for that, something to do with social order and public policy in light of a global pandemic?

CFR is not everything, you may survive the first round, with neurological damage, bone damage, lung damage, testicular damage, heart damage, psychological damage, and kidney damage.

> it’s by no means the apocalypse

This may be how you cope, but you can't say this for sure. There is a proper chance at a global crisis, with the impact of the Spanish Flu or WWII. There is too much uncertainty to be complacent and factually discard this. This novel virus is from extremistan, and we "just don't know the damage this virus can do".

reply

arcticbull 10 days ago [-]

> So the WHO tells you it's serious and concerning. Not that it is as severe as the common flu. Did we see proper management of outbreaks in the West? Well...

As they should have until they knew it wasn't as serious as they initially expected.

> CFR is not everything, you may survive the first round, with neurological damage, bone damage, lung damage, testicular damage, heart damage, psychological damage, and kidney damage.

There's zero evidence for any of that.

> This may be how you cope, but you can't say this for sure. There is a proper chance at a global crisis, with the impact of the Spanish Flu or WWII.

There's zero evidence for that too.

Yet another day goes by, yet another day with fewer active cases than the previous day. Yet another day with more resolutions and fewer deaths. We're down to 39K cases active from a peak of 58K.

reply

confeit 10 days ago [-]

Meanwhile the CFR was upgraded from 2.3% to 3.6%.

Evidence of permanent lung damage and psychological damage and kidney damage well-established. The others are by comparing SARS-CoV-1 with SARS-CoV-2.

The WHO telling you it is serious and concerning is from their latest report and findings after returning from China.

Europe is going exponential. There is now a more severe and more infectious strain identified.

reply

confeit 6 days ago [-]

Last update:

Please see https://www.youtube.com/watch?v=dcJDpV-igjs for Dr Richard Hatchett on the (long-term) dangerous effects of SARS-CoV-2. "Spanish Flu" and "WWII" he says.

3 weeks ago the first Italian got infected. 25% of Italy is now quarantined, no way to go out and buy tinned foods, without risking a 3 months detention and 200$ fine. U.S. hospitals seemingly prepare for 96 million Americans infected, 4.3 million needing hospitalization, and 480.000 deaths, or, to explain to their bosses: "10 times a flu season from hell" on top of their regular work. [1]

Italian hospitals are proposing an *age limit* for admission to the ICU for viral pneumonia / breathing problems, so they

can focus on the young people who will have more years to live.

In China we read that those people go home and take their last breath with their family, watching or hearing their old ones take their last breath, maybe some anti-virals if still available, maybe an open-source pandemic ventilator made by citizen scientists?

Or can we all work together, to reduce the community spread of this virus by just 1% by taking a pro-active scientific approach? 100s of thousands of Americans (or even world citizens) could be saved or improved, if we stop talking about a "carona flu" now.

[1] *CDC estimates that influenza was associated with 490,600 hospitalizations, and 34,200 deaths during the 2018–2019 influenza season.*

reply

divbzero 13 days ago [-]

0.7% mortality rate for 2019-nCoV is inaccurate.

We do not know the mortality rate with any precision at this point and early estimates place it far higher than 0.7%.

Let’s be neither alarmist nor complacent, but above all get our facts right and avoid spreading misleading information.

reply

arcticbull 13 days ago [-]

The WHO pins it at 0.7% and falling as understanding thereof and treatment improves [1 - page 12, graph on page 13]. This makes a lot of sense as the earliest numbers were based only on people presenting severe symptoms, and huge quantities of people with nCoV are completely and totally asymptomatic.

As with the flu, mortality is highest in older people, and the immunocompromised.

[1] https://www.who.int/docs/default-source/coronaviruse/who-chi...

reply

divbzero 13 days ago [-]

Thank you for providing the source. This helps tremendously in clarifying and advancing the discussion.

We need to be careful about what exactly the WHO is reporting. In this case, they are reporting estimates of the *crude fatality rate* defined as *deaths* / *total cases*. This will equal the mortality rate once the outbreak is over, but has limited use during the outbreak as they call out in footnote:

> The Joint Mission acknowledges the known challenges and biases of reporting crude CFR early in an epidemic.

During the outbreak, a better but still imperfect estimate is *deaths* / *settled cases* where *settled cases* is the sum of deaths and recoveries. [1]

[1]: https://news.ycombinator.com/item?id=22399755

reply

arcticbull 13 days ago [-]

Indeed, I am basing my confidence on the trendline in the graph on page 13. The number of people infected (41K) is about two thirds

now as compared to the peak (58K), and the CFR is dropping exponentially as cases resolve.

reply

eveningcoffee 13 days ago [-]

The situation outside of Hubei looks encouraging but the data appears to indicate that there is probably a threshold of patients (different for each country) from which the mortality starts to rise.

Reasons behind this might be either institutional or purely statistical that is it might be possible that each country can keep alive at least certain number of critical patients and starts to fail when certain number is exceeded and it is possible that smaller number of patients are not representative enough and do not contain high risk patients (elderly, people with other chronic illness etc).

Edit: Diamond Princess is not representative because people have been evacuated and are now counted under countries statistics https://www.bloomberg.com/news/articles/2020-03-01/man-dies-...

reply

cjbprime 13 days ago [-]

Like you say, if you are over 70 and get it, your mortality rate would be more like 10%, even with these lower numbers.

> This makes a lot of sense as the earliest numbers were based only on people presenting severe symptoms, and huge quantities of people with nCoV are completely and totally asymptomatic.

Isn't another possible explanation that it simply takes very sick people a few weeks to die from it, so if you start counting a week farther back then the confirmed-then-died rate will be higher? (Due to undercounting of people who are going to die from it but haven't yet.)

reply

arcticbull 13 days ago [-]

For comparison, the H1N1 influenza (the most common subtype in 2009) had a fatality rate of 0.45%. In the elderly (65+) studies shown it had a case fatality rate of up to 10% [1].

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3809029/

reply

confeit 13 days ago [-]

WHO wants to have their cake and eat it too. They designate Covid-19 as the severe disease, and want only those numbers confirmed with tests. Then to calculate death rate they look at everyone who is infected with novel coronavirus, including those that have not recovered yet.

> huge quantities of people with nCoV are completely and totally asymptomatic.

From 72.314 cases, as of February 11, 2020, only 889 asymptomatic cases (1%).

https://jamanetwork.com/journals/jama/fullarticle/2762130

reply

arcticbull 13 days ago [-]

Well, if they're asymptomatic they don't seek treatment right? So how would you catch them, except incidentally to incidents like the cruise ships.

reply

confeit 12 days ago [-]

> However, the total number of COVID-19 cases is likely higher due to inherent difficulties in identifying and counting mild and asymptomatic cases.

> Nevertheless, all CFRs still need to be interpreted with caution and more research is required.

Like the cruise ships:

> The ministry has tested 4,061 people so far, of which 705 were positive, including 392 people who were asymptomatic.

So seems your estimate of "huge numbers of asymptomatic" is not far from the mark. Apologies. See also:

> Asymptomatic infection has been reported, but the majority of the relatively rare cases who are asymptomatic on the date of identification/report [due to contact testing] went on to develop disease. The proportion of truly asymptomatic infections is unclear but appears to be relatively rare and does not appear to be a major driver of transmission.

https://www.who.int/docs/default-source/coronaviruse/who-chi...

reply

empiricus 13 days ago [-]

From same report: "6.1% [of infected] are critical (respiratory failure, septic shock, and/or multiple organ dysfunction/failure)." This does not look like the kind of thing you can treat DIY style.

reply

kelnos 13 days ago [-]

"Early estimates place it far higher than 0.7%" seems both incorrect and a bit alarmist.

From what I've read (see below), the current consensus is that China is under-reporting total infected, possibly by an order of magnitude. China also made several missteps in their initial and ongoing response that is likely increasing their mortality rate, especially in Wuhan and surrounding Hubei. Worldwide, there certainly are and will be people who are infected but are asymptomatic, and don't even know (and of course aren't being counted at all).

I *would* expect that the mortality rate outside China is -- and will stay -- sub-1%, unless it mutates and becomes more deadly, or if health services eventually become overwhelmed due to quick spread. Analysis of primary data seems to indicate that even non-Hubei China has a mortality rate around 0.7%; Hubei's mortality rate is skewing the total upward by a lot. Rest-of-world looks to be around 0.6% so far.

https://www.cnn.com/2020/02/19/health/coronavirus-china-sars...

https://www.bmj.com/content/368/bmj.m606

https://github.com/CSSEGISandData/COVID-19 (primary data, which links to some analysis and visualizations)

reply

eveningcoffee 13 days ago [-]

It looks to me that there is probably a threshold of patients (different for each country) from which the mortality starts to rise.

Reasons behind this might be either institutional or purely statistical that is it might be possible that each country can keep alive at least certain number of critical patients and starts to fail when certain number is exceeded and it is possible that smaller number of patients are not representative enough and do not contain high risk patients (elderly, people with other chronic illness etc).

If you look at the recent data then when number of patients approaches 100 then mortality (CFR) exceeds 2%. Only exception seems to be South-Korea. Diamond Princess is not representative because patients are now evacuated and counted under their countries statistics.

reply

mike_d 13 days ago [-]

> It's got a mortality rate of 0.7% (same order of magnitude as the garden variety flu)

The Spanish Flu only had a mortality rate of 1.2% and killed over 30 million people.

reply

arcticbull 12 days ago [-]

Seasonal flu kills ~650K/yr every year. We live in a risky world. [1]

[1] https://www.medicinenet.com/script/main/art.asp?articlekey=2...

reply

mjmdavis 13 days ago [-]

This has genuinely given me hope. It would be great to see more ideas and work around this.

reply

ficklepickle 13 days ago [-]

It reminds me of the baby incubator made from car parts.

https://blogs.scientificamerican.com/news-blog/babys-hot-whe...

reply

im3w1l 13 days ago [-]

Wow to think someone wrote this 12 years ago. I feel there is a lesson here but I don't know what.

reply

arcticbull 13 days ago [-]

The lesson is diseases happen, and then they go away and we forget all about them. Bird flu, swine flu, SARS, MERS and soon nCoV-19. The number of active cases is approaching half of what it was at peak, and the mortality rate is now close to 0.7% - and largely weak/immunocompromised patients, the same order of magnitude as the normal flu. Further, a few groups claim a vaccine is only a few months away, and it responds to some existing antiviral medications.

reply

ericb 13 days ago [-]

> a few groups claim a vaccine is only a few months away

That's just wrong as it would take months and months to test before you could deploy it. At least one of the vaccines for SARs actually made things worse, if memory serves. Not to mention the manufacturing ramp up time.

The map is not the territory. For example, in the US, it is entirely unclear how many cases there are as only 400 tests have been done in total.

Hopefully the antivirals will work out.

reply

wbl 13 days ago [-]

In Qoom nothing has been done. The Iraniam government refuses to take even the most basic control measures.

reply

arcticbull 13 days ago [-]

It also has a 0.7% case fatality rate in China (and 0.6% outside) on par with H1N1 at 0.45%. Nothing really *needs* to be done -- this time. The

situation would be far, far worse with a disease that actually killed a lot of healthy individuals.

reply

blagie 13 days ago [-]

Worldwide, there were 2,979 deaths and 42,576 recovered. That math suggests you might have an extra decimal point there. There are many ways to do the math, but 0.7% is not really a sensible number to work from. General consensus hovers at 2-3%.

Aside from that, a much larger (as of yet unknown) number have permanent lung scarring. That's not a joke. Read about SARS and MERS long-term prognosis from similar scarring.

reply

arcticbull 12 days ago [-]

That's unfortunately a common misunderstanding of how CFR or case fatality rate works. It begins huge as only the most serious cases are identified as nCoV and it falls as the long tail comes into view.

Over the last few days, we've seen thousands of recoveries and tens of deaths. Marginally, it's 0.6% globally from the latest WHO data. The media is sensationalizing this and playing on peoples fears and emotions.

Check out the graph on page 13 of the WHO report: https://www.who.int/docs/default-source/coronaviruse/who-chi...

> Aside from that, a much larger (as of yet unknown) number have permanent lung scarring. That's not a joke. Read about SARS and MERS long-term prognosis from similar scarring.

To your own point, we have no idea if it's even a thing. Just because SARS, MERS and nCoV are all coronaviruses doesn't mean they act the same way. MERS has a 35% fatality rate vs. and I can't stress this enough 0.6%, so two whole orders of magnitude less fatal.

reply

popotamonga 13 days ago [-]

Can you actually buy a consumer ventilator? I would see myself paying up to 10k for a ventilator to have at home just in case...

reply

refurb 13 days ago [-]

If you're so sick you need a ventilator, you're also going to need a ton of supportive care as well.

The chances of a ventilator being the one missing link between life and death (outside of a hospital) is pretty small.

reply

evv555 13 days ago [-]

The chance of it being the missing link within a hospital seems large though. I imagine there are more beds then there are ventilators in any given hospital.

reply

_jal 13 days ago [-]

So the plan is to keep one around the house, maintained in good condition, to take with you to the hospital?

reply

evv555 13 days ago [-]

No. The current survival stats involve 20% of those infected ending up in ICU. If this was to become a pandemic that would require millions of respirators to maintain that survival rate. Think about that and what "condition" you would accept for a respirator.

reply

refurb 13 days ago [-]

And if the staff is t trained on that particular model, there is no way they’ll use it.

reply

TylerE 13 days ago [-]

A cpap, or especially s bipap will come pretty close. Not the same in that isn’t true life support, but it does make breathing _much_ easier.

I use a cpap at home for sleep apnea and was on a bipap for about 48 hours when hospitalized for pnuemonia.

Machines cost about $500-1500 dollars. Do require a percription though.

reply

JshWright 13 days ago [-]

CPAP is a good way to prevent someone from getting intubated later on. It doesn't reduce the risk entirely, but early and aggressive CPAP usage can definitely reduce the likelihood of a pt needing intubation further down the line (more common w/ asthma/COPD, but there is some evidence supporting its use w/ ARDS pt's as well)

reply

anonuser123456 13 days ago [-]

In not sure this is true. CPAP/PEEP are used for first line mild ARDS. But it seems hard to find any conclusive evidence for efficacy. It definitely makes people more comfortable, but it's hard to say if the clinical efficacy is really there.

reply

JshWright 13 days ago [-]

The evidence is stronger in the case of mild ARDS (early NIVPP reduces intubation rates), by the time it has progressed to moderate/severe ARDS, it's too late and NIVPP isn't going to do any good.

Apologies that I'm on my phone right now and don't have links at hand, but I have done some reading on this topic recently.

reply

JshWright 13 days ago [-]

Outside the edit window, but this is one of the studies I was referring to: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4057073/

From the conclusion:

> Intubation rates did not exceed 35% in non-ARDS and mild ARDS and NIV may thus be used as the first-line ventilatory support ... By contrast, 84% of severe ARDS required intubation and NIV does not appear beneficial in this subset of patients ... In patients with moderate ARDS, NIV may be worth attempting in those having a PaO2/FiO2 ratio >150 in the absence of hemodynamic instability or altered consciousness ...

There are definitely significant shortcoming to that study (single facility, etc), but it definitely points in the direction of

CPAP being a viable treatment, especially if it's used aggressively (initiated early, high PEEP, etc)

reply

maire 13 days ago [-]

You used to be able to buy high quality CPAP machines on Amazon. I don't see them any more.

There are also streamlined processes to get the prescription. You take the machine home over night and they monitor your breathing remotely.

Years ago I successfully argued with a CPAP company about their jacked up rates and was able to find the exact same CPAP machine for about 1/3 the cost.

Good to know that I can also use it for a pandemic. ;-)

reply

elric 13 days ago [-]

CPAP makes inhaling easier, but it makes exhaling harder. Some CPAP devices have a setting that drops the pressure when exhaling, but not all of them do.

CPAP devices don't require a prescription to buy in many places around the world. You can easily buy them online, and setting the pressure is very easy on many models. A prescription could be useful for figuring out the pressure you need, but it's pretty common for people in countries with shitty healthcare systems to just buy a machine and self-titrate.

reply

JshWright 13 days ago [-]

In the case of ARDS (which is what the sickest coronavirus patients end up with), it's actually that expiratory pressure that's important (you wouldn't want to configure the CPAP to drop the pressure on exhalation).

With ARDS the lungs fill with fluid, which causes the little sacs in the lungs (where gas exchange actually happens) to collapse and 'stick' closed. The higher 'baseline' pressure[1] helps keep them open.

[1] This is known as "PEEP" or "Peak End Expiratory Pressure", i.e. the pressure in the lungs at the end of exhalation. For ARDS/pneumonia patients, you want high PEEP.

reply

jacquesm 13 days ago [-]

10k for the ventilator is on the low side, but assuming you could buy one you still need an ICU or rough equivalent to take care of everything else and a massive autoclave for periodic sterilization or you're going to get a nice infection on top of your already very bad air supply situation. This is well outside of DIY territory, though there are people living in 'Iron lungs' for decades (but those are typically strong enough to survive for a while outside of them and can breathe independently if they have to, they use the iron lungs for relief).

reply

JshWright 13 days ago [-]

Would you also hire a respiratory therapist on retainer to operate it for you?

reply

Aeolun 13 days ago [-]

Probably better to hire one to train you in it’s operation.

reply

popotamonga 13 days ago [-]

My wife is ICU medic

reply

JshWright 13 days ago [-]

Not sure what you mean by "medic" in this case, but does she have much experience running a vent? ARDS requires very careful management of ventilator settings (in addition to a whole host of other care), and is typically handled by specially trained respiratory therapists in a hospital setting.

reply

mjmdavis 13 days ago [-]

Doing this could deprive hundreds of people of a life saving device.

reply

Aeolun 13 days ago [-]

If it’s on the open market it’s presumably not saving any lives.

If it does get to the point where we have to pull everything off the open market, then maybe, but you can always go and offer it to a local hospital.

reply

anonuser123456 13 days ago [-]

Prices and consumption signal producers the relative importance of a good. Its better for people to drive prices up so suppliers can respond appropriately.

Right now it makes sense for instance for defense companies (eg large manufacturing corps) to partner with med corps (who's supply chains are in shambles) to start cranking these our.

But they won't unless the profit/market is there for it.

reply