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Lots of people are wondering how bad Long COVID is, especially among those who are fully vaccinated. I've been reading a lot about this.

Disclaimers: I'm not an expert on any of this. I'm not particularly experienced with analyzing studies and finding their limitations/biases. I haven't read all of my sources in detail, and there are many Long COVID studies out there that I didn't read at all. (Feel free to let me know if you think I've mischaracterized anything -- this document is comment-able!)

That said, here are my main thoughts. Sources informing these thoughts are listed below.

1. We'll probably see a study soon [1] showing a reduction in the risk of developing Long COVID in fully vaccinated individuals.
2. Long COVID studies follow up with patients at different lengths of time post-infection. I've seen approximately 4 weeks, 60 days, 12 weeks, and 6 months.
    a. This matters because **post-acute symptoms are more common when you look at shorter timeframes post-infection**. A UK study of health records [6] showed that a greater proportion of patients reported symptoms at 4 weeks than 12 weeks.
    b. Most of us are worried about symptoms that ruin our lives indefinitely rather than symptoms that ruin a few months. **Studies that only look at relatively short timeframes are likely overestimating the statistics we care about.**
    c. Studies that look at shorter timeframes don't seem to be differentiating between "extended time recovering from acute COVID" and "Long COVID."
        i. If someone with symptomatic COVID suffers continuously for 6 weeks, I think it makes sense to consider that simply a long recovery time. If someone with *asymptomatic* COVID suddenly develops alarming symptoms 4 weeks post-diagnosis, I'd call that Long COVID. (There are many possibilities in between these two scenarios, and those are harder to classify.)
        ii. Open question: When we observe "a greater proportion of patients report symptoms at 4 weeks than 12," is this just because many patients had an extended recovery time? Or do many people develop Long COVID symptoms (distinct from their acute symptoms) by week 4 and then recover from those by week 12?

    1. The answers to these questions affect how concerning stats like "19% of asymptomatic patients develop Long COVID symptoms 30+ days later" [3] are.

3. Some Long COVID symptoms are also symptoms of depression. Lockdown-related depression could be mistaken for Long COVID in studies that don't use the general population as a control group. Lots of these studies provide statistics on "fatigue," and unfortunately, I generally don't see them doing anything to differentiate between Chronic-Fatigue-Syndrome-esque fatigue vs depression-esque fatigue. **However, most of the symptoms in these studies (e.g. difficulty breathing, loss of smell/taste) are *not* normal symptoms of depression.**

4. The most rigorous-looking study I read [4] followed up with patients 6 months post-infection and had a control group. They calculated statistically significant excess burdens in many symptom categories.

    a. The numbers they came up with aren't really that concerning to me. The most commonly reported post-acute health issue was respiratory conditions. Excess burden was 28.5 per 1000 patients.

    b. They demonstrate that patients with more severe COVID infections have far higher risks of post-acute symptoms. This is reassuring for vaccinated folks, since vaccines are proven to reduce illness severity.

    c. Every other Long COVID paper I've read seems less optimistic than this one, though, so I don't feel quite comfortable taking these numbers at face value.

Also, I do have a personal connection to this issue. I have Myalgic Encephalomyelitis / Chronic Fatigue Syndrome (ME/CFS). Many Long COVID sufferers have what seems to be ME/CFS.

It's a bad illness. You don't want it. Nearly every day of my life since I've developed ME/CFS has been centered around trying to find some way to get better. I think people without ME/CFS undervalue how bad it is because it's hard for them to fathom that anything this bad (yet non-fatal!) even exists.

All that said, I really don't know how common the ME/CFS outcome is. Studies I've read aren't surveying the symptoms necessary for an ME/CFS diagnosis, nor are they quantifying symptom severity. Pessimistic people on Twitter told me 1/3 of Long COVID sufferers end up with ME/CFS, but no one ever gave me the source for that, and that sounds higher than I would expect. "How many people with COVID end up with ME/CFS?" seems like a better question, so that the resulting ratio isn't relative to anyone's definition of non-ME/CFS Long COVID.

Sources

Long COVID post-vaccination

We have very little research on this. I'm pretty much waiting for the research mentioned in #1 to come out.

[1]: Delta surge 'could leave hundreds of thousands with long Covid' (The Guardian, not a study)

Dr Claire Steves claims that risk of Long COVID is greatly reduced when you get two doses of a vaccine. She does not say by how much.

I want to see the actual study before getting my hopes up too much. Matt Bell emailed the author of the study, and they said that publication has been delayed.

[2]: Post-vaccination SARS-CoV-2 infection: risk factors and illness profile in a prospective, observational community-based case-control study

At-least-once-vaccinated adults 60+ had a 0.72 odds ratio for symptoms lasting ≥ 28 days (in comparison to 60+ adults that were not vaccinated). There were no statistically significant results for those aged 18-59. This study considered patients who had received one dose of a vaccine by the time they were infected with COVID; hopefully two doses provide more protection. (Note: Not sure if the study looked at "at least one dose" or "exactly one dose"; I would need to look through the study again to verify.)

This is based on self reports in an app. People with Long COVID may disproportionately give up on using the app due to usability issues.

Long COVID among unvaccinated patients

[3]: A Detailed Study of Patients with Long-Haul COVID

FAIR Health claimed that 19% of asymptomatic COVID patients went on to develop Long COVID symptoms 30 or more days later. 27.5% of patients who were symptomatic but not hospitalized got Long COVID symptoms.

They had no control group, although they did verify that the symptoms were not previously in a patient's history. We don't know how common the listed symptoms were among the general population during lockdown.

I expect this is an overestimation because they only looked at 30 days post-diagnosis. Source #6 notes that a greater proportion of patients reported symptoms lasting 4 weeks than 12 weeks.

[4]: High-dimensional characterization of post-acute sequelae of COVID-19

This is a dense paper with a lot of information. It shows the increased rate of symptoms, diagnoses, medication use, and lab abnormalities among COVID patients (compared to a control group without COVID).

The risks of lasting health issues were much greater among hospitalized patients, and greater still among patients admitted to intensive care. See figure 3.

Excess burdens in this paper are per 1,000 COVID patients at 6 months post-infection. Excess burdens of various conditions:

- Respiratory conditions: 28.5
- Nervous system conditions: 14.32
- Sleep-wake disorders: 14.53
- Anxiety: 5.42
- Malaise and fatigue: 12.64
- Cardiovascular conditions: 15.18

Divide by 10 to get the risk percentage. e.g. The risk of having a respiratory condition was 2.85 percentage points greater for patients who had COVID than healthy controls. Note that these numbers are much smaller than the numbers in sources #3 and #5.

[5]: Long COVID in a prospective cohort of home-isolated patients

Researchers recruited 312 patients early in the pandemic; most were symptomatic. Among the non-hospitalized (referred to as "home-isolated" in the study) patients, 55% had persistent symptoms at 6 months. 30% had fatigue, 27% had disturbed taste/smell, 19% had cognitive impairment, 15% had dyspnea (difficult/labored breathing).

I'm guessing that since this was early in the pandemic, before testing was widespread, these cases were more severe than average.

[6]: Risk factors for long COVID: analyses of 10 longitudinal studies and electronic health records in the UK

"Symptoms impacted normal functioning for 12+ weeks in 1.2% (mean age 20 years) to 4.8% (mean age 63 y) of COVID-19 cases. Between 7.8% (mean age 28 y) and 17% (mean age 58 y) reported any symptoms for 12+ weeks, and greater proportions for 4+ weeks. Age was associated with a linear increased risk in long COVID between 20 and 70 years."

[7]: Prevalence of long COVID symptoms and COVID-19 complications

According to table 2, these are the rates of various symptoms at five weeks post-infection:

- Fatigue: 11.5%
- Cough: 11.4%
- Headache: 10.1%
- Loss of taste: 8.2%
- Loss of smell: 7.9%

This dataset does not appear to 1) exclude patients who already had these symptoms in their history, 2) compare to the general population during lockdown. So the fatigue rate could be an overestimate.