

Identifying Terminological Biomarkers of Long COVID

Through Narrative Medicine and Ontology Mapping

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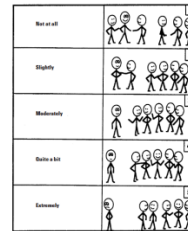
Deficient usual medicine

Gravity (DUSOI)

Table 1.1 – Diagnostic labels recorded for the first 50 Long COVID patients in the Charleroi cohort (2021–2022). Source: M. Jamouille.

- Generalized anxiety disorder
- Angina pectoris
- Alzheimer's disease
- Pulmonary embolism
- Hyperventilation
- Fibromyalgia
- Traumatic shock
- Occupational exhaustion
- Panic attacks
- Post-traumatic stress disorder
- Depression
- Lazy adolescent (comment from a teacher)
- Irritable bowel
- Functional colopathy
- Burnout
- Malingering
- Autism spectrum disorder (comment from a psychiatrist)

Sender ---- Receiver
Both in the fog
No communication



Functionnal indicators
COOP WONCA

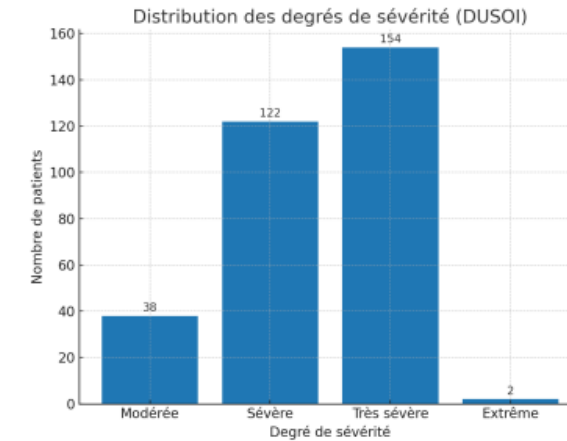


Figure 3.4 – Severity levels of the cohort according to the DUSOI. Data available for 316 patients out of a total of 337 included (as of January 15, 2025; consultations Dr. Jamouille, 2021–2025).

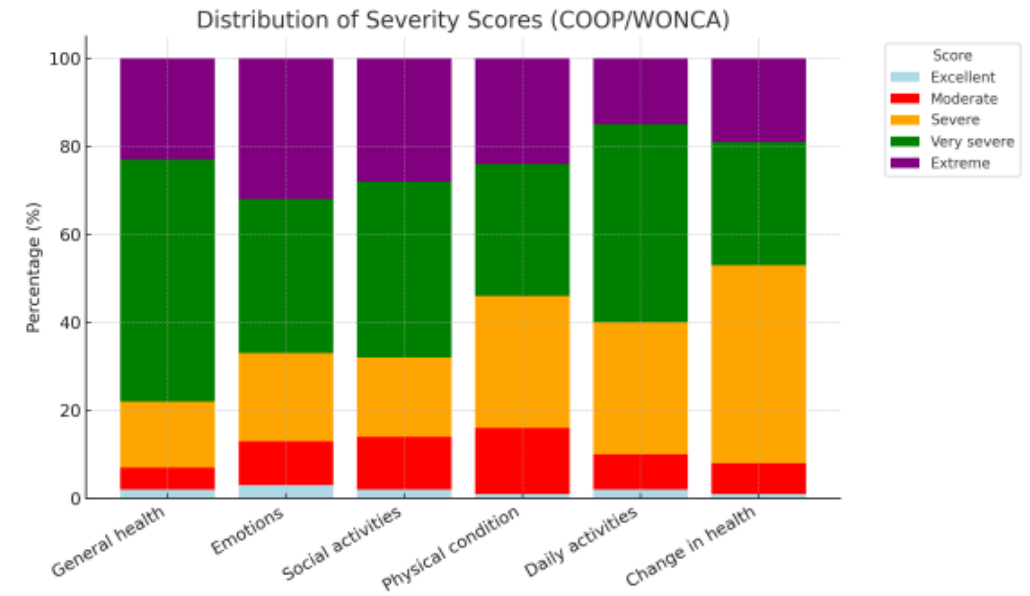
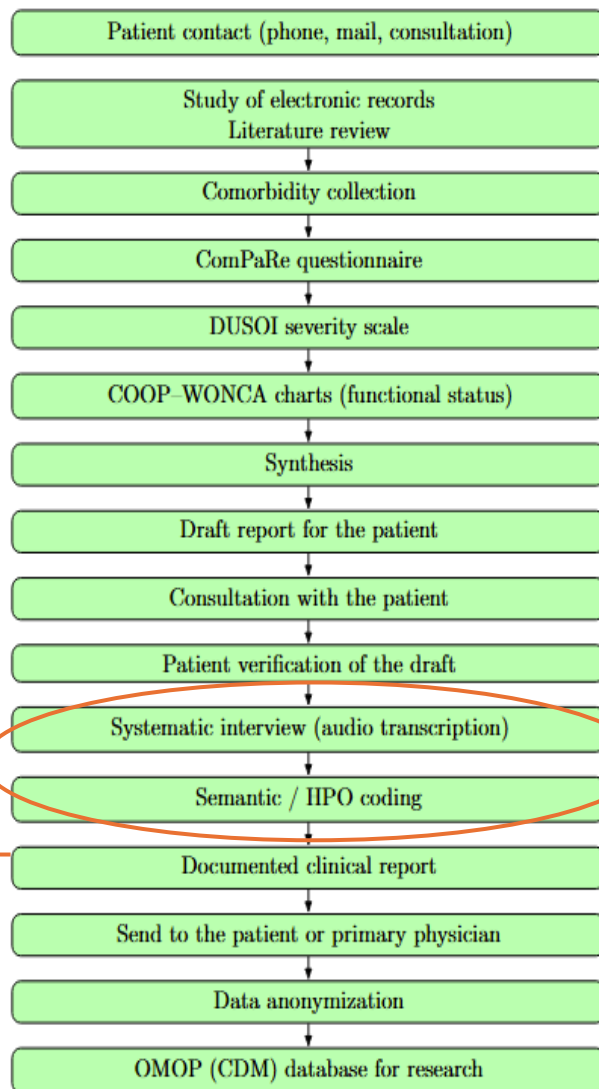


Figure 3.6 – Distribution of severity scores from the 6 COOP Charts perceived by 203 patients. We observe that health status is severely impaired, remains unchanged, or worsens. Under these conditions, patients can no longer work and schoolchildren no longer attend school.

research pathway based on patient doctor partnership

Sick patients

Nuclear medicine



Multimics

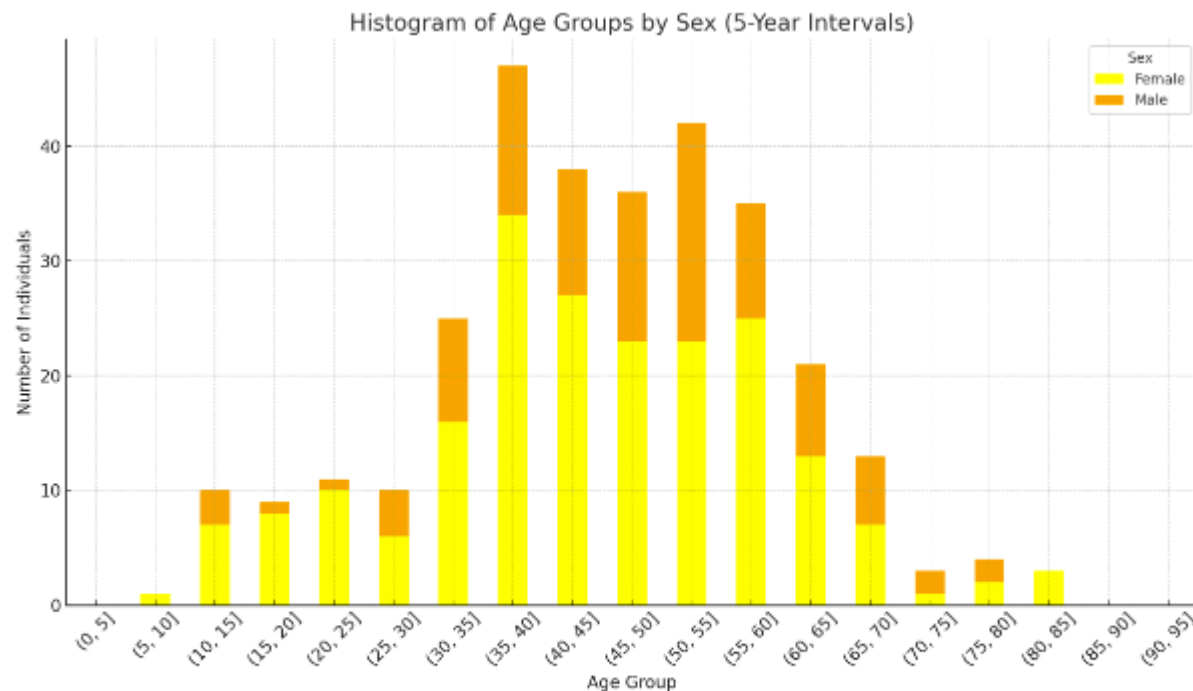


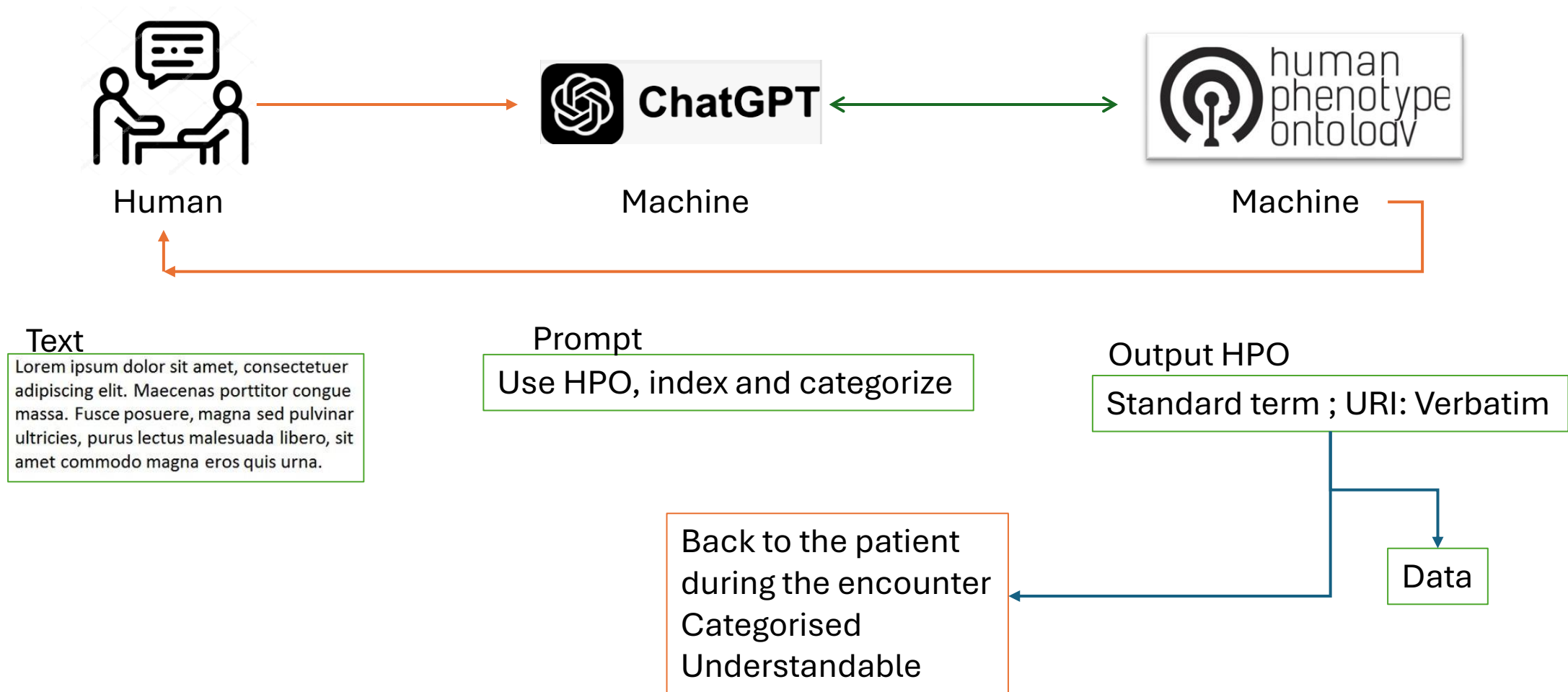
Figure 2.4 – Operational chain: from the first patient contact and initial data collection to the OMOP Common Data Model (CDM) research database.

Figure 3.2 – Age and sex distribution of all consulting patients clinically affected by long COVID (307 people as of July 1, 2025). Women: 67%. Youngest patient: 6 years, oldest: 83 years. Consultations, Charleroi. Dr. Jamouille and Dr. Zayane, 2021–2025.

Symptom oriented interview
Pseudonymised
Transcription on vook.ai
Copy paste on CHATGPT
Specific PROMPT using HPO

Large Language Model an artificial intelligence system trained on vast amounts of text to understand and generate human-like language.

Human Phenotype Ontology (HPO) is a standardized vocabulary that describes **human disease symptoms and traits** (phenotypes) in a structured, computer-readable way.



Task

1. Identify all post-COVID symptoms.
2. Map each to the correct HPO term (English) and official code (HP:#####) using the HPO reference ; never invent codes.
3. If uncertain or not found, write **UNKNOWN** (filled by script).
4. Output exactly:

```
less
```

 Copier le code

```
HPO term (HP:#####) [verbatim] ; HPO term (HP:#####) [verbatim] ; ...
```

Constraints

- HPO terms in **English**.
- Patient wording **verbatim in brackets** (no edits).
- Use `;` (semicolon + space) as the **only separator**.
- Return **only** the formatted list (no commentary).

Fixed fields for Excel

```
ini
```

 Copier le code

```
person1_id = nnnnn | start_date = today
```



Email received from a patient, September 2024

When I crash, it is almost always the same symptoms: overwhelming fatigue, a burning sensation in the brain, the feeling that molten lead is flowing through my veins, pain in my hands and feet, memory and speech problems, difficulty moving around, occasional hair loss, chest pain near the heart, and since September, difficulty breathing. But there are also moments when I feel completely fine, and I make the most of it :) Overall, things are improving, slowly but surely. I was first infected in October 2020.

Neurological

Fatigue (HP:0012378) – [overwhelming fatigue]

Burning sensation (HP:0011123) – [burning sensation in the brain]

UNKNOWN – [the feeling that molten lead is flowing through my veins]

Memory impairment (HP:0002354) – [memory problems]

Dysarthria (HP:0001260) – [speech difficulties]

Gait disturbance (HP:0001288) – [difficulty moving around]

Pain / Musculoskeletal

Upper limb pain (HP:0009763) – [pain in the hands]

Lower limb pain (HP:0001347) – [pain in the feet]

Dermatological

Alopecia (HP:0001596) – [occasional hair loss]

Cardiorespiratory

Post-exertional malaise (HP:0030973) [when I crash]

Chest pain (HP:0100749) – [pain in the chest near the heart]

Dyspnea (HP:0002094) – [difficulty breathing]

HPO



ChatGPT



human
phenotype
ontology

00:03:08 – SPEAKER_02

There's some dizziness.

00:03:09 – SPEAKER_00

What kind?

00:03:11 – SPEAKER_01

More like loss of balance — I don't really know how to explain it, but it's as if I can't quite control my movements, for example my arms or something.

00:03:25 – SPEAKER_02

Alright.

00:03:26 – SPEAKER_00

You don't know where they are?

00:03:29 – SPEAKER_02

As if you didn't know where your arms or your hands are?

00:03:32 – SPEAKER_01

And when I change position too, I get dizzy.

00:03:37 – SPEAKER_02

So you get dizzy when you change position?

My vision gets blurry.

And your vision becomes blurry.



Indexed HPO terms

| Symptom (English) | HPO Term | HPO ID |
|----------------------------------|-------------------------|--------------|
| Dizziness | Vertigo | HP:0002321 ↗ |
| Loss of balance | Imbalance | HP:0002141 ↗ |
| Poor control of movements | Ataxia | HP:0001251 ↗ |
| Not knowing where arms/hands are | Impaired proprioception | HP:0007913 ↗ |
| Dizziness when changing position | Positional vertigo | HP:0002521 ↗ |
| Blurred vision | Blurring of vision | HP:0000622 ↗ |

For the patient

The entire process takes only a few minutes.

A transcript is provided to the patient — here translated into Turkish, as the husband does not understand French.

Един голям езиков модел...

с намигване към нашите български приятели!

Енергия и метаболизъм

Умора (HP:0012378) [Чувствам се уморен, задъхвам се, изтощен съм]

Хиперсомния (HP:0002189) [Спя по цял ден; спя твърде много]

Психическа умора (HP:0033413)
[Психически съм изтощен]

Дихателна система

Задух (HP:0002094) [Задъхвам се; трябва да поемам дълбоки вдишвания, за да изкача стълбите]

Dr Jamouille
06/10/2025
transcription de l'interview de 417

Enerji ve metabolizma

Yorgunluk (HP:0012378) [yorgunum, nefes nefese kalıyorum, bitkinim]
Hipersomni (HP:0002189) [bütün gün sadece uyuyorum; çok fazla uyuyorum]
Zihinsel yorgunluk (HP:0033413) [zihinsel olarak yorgunum]

Solunum

Nefes darlığı (HP:0002094) [nefes nefese kalıyorum; merdiven çıkmak için derin nefes almam gerekiyor]

Biliş ve hafıza

Konsantrasyon bozukluğu (HP:0100543) [odaklanamıyorum, düşünmekte zorlanıyorum]
Hafıza bozukluğu (HP:0002354) [hatırlamıyorum; bana söylenenleri unutuyorum; arkadaşlarım aynı şeyi defalarca söylüyor]
Yönelim bozukluğu (HP:0001281) [yakın yerlere gitmek için bile GPS kullanmam gerekiyor]
Psikomotor yavaşlama (HP:0002310) [beynim uyuyor; erken kalkıyorum ki biraz uyanık olsun]

Dil ve iletişim

Afazi (HP:0002381) [bazı kelimeleri söyleyemiyorum; kendi kelimelerimi kullanmak zorundayım]
Dolaylı konuşma (HP:0031546) [bir konudan diğerine atlıyorum]

Görme

Bulanık görme (HP:0000622) [bulanık görüyorum]

Cinsel işlev

Azalmış libido (HP:0000135) [cinsel isteğin kaybolması]

Energy and Metabolism

Fatigue (HP:0012378) [I'm tired, short of breath, exhausted]

Hypersomnia (HP:0002189) [I sleep all day; I sleep too much]

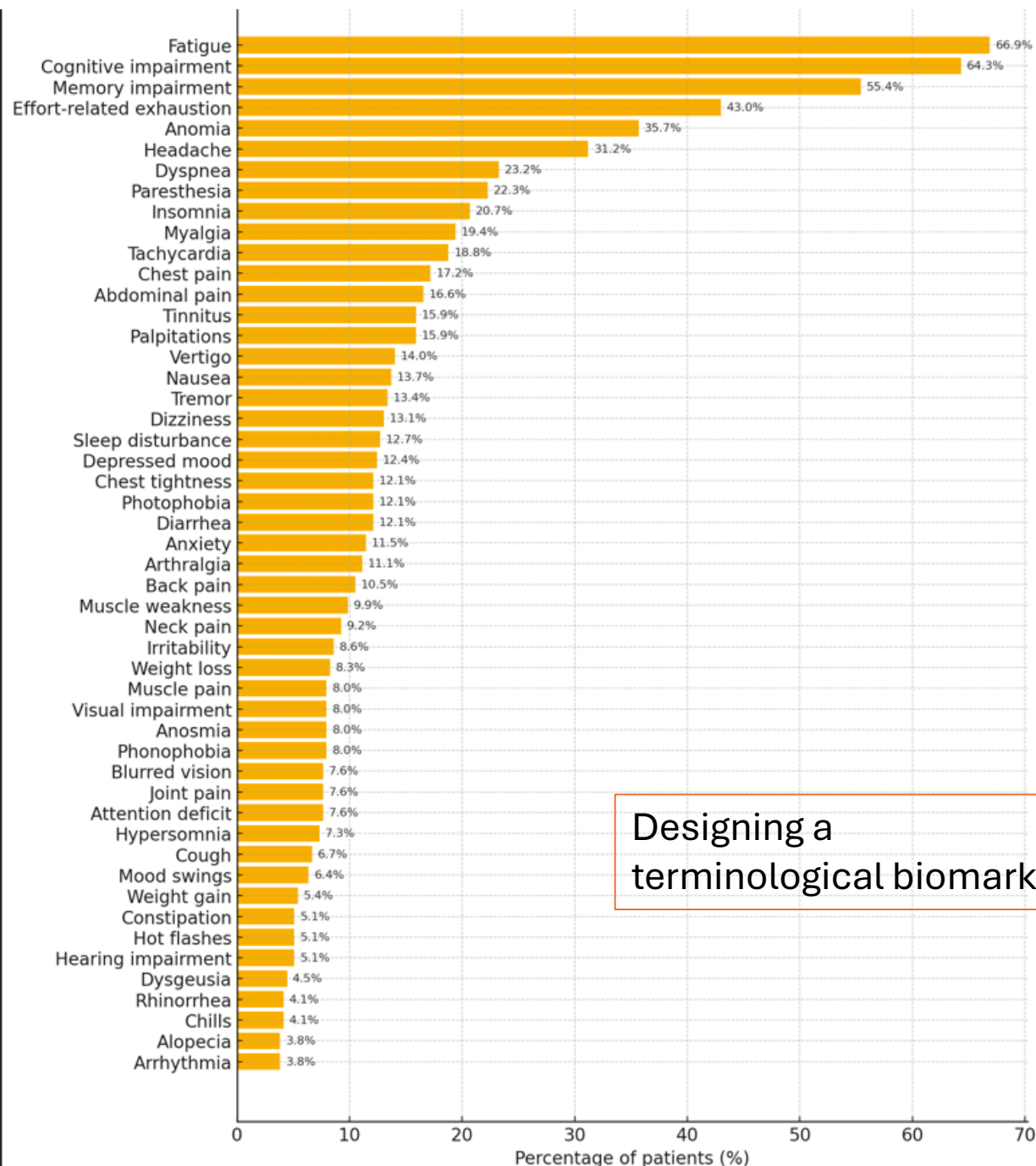
Mental fatigue (HP:0033413) [I'm mentally tired]

Respiratory

Shortness of breath (HP:0002094) [I'm short of breath; I need to take deep breaths to climb stairs]

DATA

| person_id | observation_source_value | n_period_start_date | birth-date | first_covid_date | |
|-----------|---|---------------------|------------|------------------|--|
| | [TIA lasting a few minutes]; Hemiparesis (HP:0001269) [transient hemiparesis of the face on the right and of the left arm]; Severe shivering (HP:0025146); Tremor (HP:0001337) [shaking all over]; Paresthesia of the hands (HP:0030087) [tingling in her hands]. | | | | |
| MGA.007 | Mood swings (HP:0000745) [mood changes]; Irritability (HP:0000737); Fatigue (HP:0012378); Depressed mood (HP:0000716); Cognitive impairment (HP:0100543); Working memory deficit (HP:0031353). | 01/02/2022 | 03/11/1966 | 01/10/2020 | |
| MGA.009 | Burnout-like feeling (HP:0035415) [generalized as fatigue]; Acute exhaustion (HP:0012378); Fatigue (HP:0012378); Muscle weakness (HP:0001324) [loss of physical strength]; Cognitive impairment (HP:0100543) [brain fog]; Memory impairment (HP:0002354) [memory problem]; Arm and hand paresis (HP:0002394); Vertigo (HP:0002321); Cold hands (HP:0000974) [cool hand]; Myoclonus (HP:0001336) [left thumb involuntary movements]; Jaw locking (HP:0002026); Petechiae (HP:0000966) [skin red dots]; Hypersomnia (HP:0002363) [sleepiness]; Hypersomnia (HP:0002363); Palpitations (HP:0001962); Tachycardia (HP:0001649) [episodic tachycardia]; Cannabis intolerance (HP:0034312); Alcohol intolerance (HP:0003230); Weight gain (HP:0004324); | 01/02/2022 | 02/03/1985 | 01/10/2021 | |
| MGA.010 | Chest pain (HP:0100749); Dyspnea (HP:0002094) [shortness of breath]; Fatigue (HP:0012378); Cognitive impairment (HP:0100543) [brain fog]; Exertional dyspnea (HP:0002875) [exertional fatigue]; Severe vertigo (HP:0002321) [catastrophic dizziness]; Basilar migraines (HP:0002076) [reactivation of basilar migraines]; Neck pain (HP:0032438) [preventing sleep]; Paresthesia (HP:0003401) [tingling]; Incoordination (HP:0002075) [inebriation]; Photophobia (HP:0000613) [intolerance to night light]; Exhaustion (HP:0012378); Feeling stuck (HP:0035415); Feeling bogged down (HP:0035415); Impaired phrasing (HP:0031002); Impaired concentration (HP:0100543); Stammering (HP:0031006); Anomia (HP:0031002) [loss of words]. | 31/01/2022 | 14/05/1982 | 01/05/2021 | |
| MGA.011 | Fatigue (HP:0012378) [extreme tiredness]; Muscle weakness (HP:0001324) [feels weak]; Severe memory impairment (HP:0002354) [severe mnemonic disorder]; Short-term memory impairment (HP:0031346) [immediate memory impairment]; Anomia (HP:0031002) [need to pause to remember what she was going to say]; Impaired concentration (HP:0100543); Paresthesia (HP:0003401) [tingling in cheeks, knees, and feet]; Eye paresthesia (HP:0031652) [tingling eyes]; Anxiety (HP:0000739) [very nervous]; Claustrophobia (HP:0010708); Social withdrawal (HP:0000737) [social contact difficult to bear]. | 31/01/2022 | 01/10/1988 | 01/10/2020 | |
| MGA.013 | Hearing impairment (HP:0000365) [hearing loss in right ear]; Balance impairment (HP:0002141) [balance always disturbed]; Dizziness (HP:0002321); Visual impairment (HP:0000505) [vision loss]; Fatigue (HP:0012378) [quickly tired]; Weight gain (HP:0004324) [weight gain ++]; Dyspnea (HP:0002094) [quickly out of breath]; Depressed mood (HP:0000716) [became depressed]; Hip pain (HP:0003348) [pain in left hip every night]; Headache (HP:0002315) [headaches after vaccinations]; Memory impairment (HP:0002354) [memory loss]; Myalgia (HP:0003326) [myalgia]; Anomia (HP:0031002) [loss of word]; Repeated speech (HP:0002540) [repeats herself and doesn't realize it]; Forgetfulness (HP:0002364) [forgets which groceries she went to get]; Impaired concentration (HP:0100543); Disseminated myalgia (HP:0032463); Insomnia (HP:0100785); Spatial disorientation (HP:0012761) [loss of sense of direction]. | 01/02/2022 | 14/05/1982 | 26/03/2021 | |
| MGA.014 | Transient anomia (HP:0030447); Cough (HP:0012735); Thoracic pain (HP:0032408); Chest pain (HP:0100749); Exertional dyspnea (HP:0002875) [effort exhaustion]; Fatigue (HP:0012378) [tiredness]; Memory impairment (HP:0002354) [memory problem]; Depressed mood (HP:0000716) [depressive feelings]; Vestibular dysfunction (HP:0001751) with nausea (HP:0002018). | 08/02/2022 | 21/11/2002 | 01/06/2021 | |
| MGA.015 | Hair loss (HP:0001596) [massive hair loss]; Diarrhea (HP:0002014); Confusion (HP:0001289); Erythematous skin patches (HP:0031420) [covered with red patches for 15 days]; Headache (HP:0002315) [headaches lasted for two months]; Nightmares (HP:0025183); Fatigue (HP:0012378) [tiredness]; Exertional dyspnea (HP:0002875) [difficulty in making efforts]; Excessive daytime sleepiness (HP:0002363) [a nap every day]; Reduced stress tolerance (HP:0012435) [loss of psychic resistance]; Severe anxiety (HP:0000739) [violent anguish unknown before]; Memory impairment (HP:0002354) [memory problem]; Anomia (HP:0031002) [loss of word]; Forgetfulness (HP:0002364) [can't find things]; Abdominal pain (HP:0002027) [intestinal pains]; Blurred vision (HP:0000622) [blurred vision since COVID]. | 01/02/2022 | 15/07/1960 | 20/10/2020 | |



Designing a
terminological biomarker

Fatigue
Cognitive impairment
Memory impairment
Effort-related exhaustion
Anomia
Headache
Dyspnea
Paresthesia
Insomnia
Myalgia
Tachycardia
Chest pain
Abdominal pain
Tinnitus
Palpitations
Vertigo
Nausea
Tremor
Dizziness
Sleep disturbance

2021-2025

- Clinical encounter
- Imagery
SPECT-CT
PET SCAN
SRM
- Molecular biology
- Transcriptomic
- Proteomic
- Deep immuno
- Neurobiology
- Genomic
- Virology



Figure 2.9 – Long COVID Research Network. The owl is the epistemologist in observation: a symbol of scientific questioning.

sources

- Online Zotero Long Covid bibliography classified on ICPC and Q-Codes
https://www.zotero.org/groups/4929325/long_covid_open_library/library



Research report 2021-2025

Jamouille, M. (Ed.) and the Long COVID Research Network. (2025). *Long COVID, invisible illness*. Charleroi, Belgium. 147 pp. ORBi — University of Liège. <https://orbi.uliege.be/handle/2268/335655>