

# Somatic symptom burden and distress in post COVID-19 and persistent physical symptoms: Evidence from combined SSD-12 and PHQ-15 factor analysis

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## ABSTRACT

**Background and Aim:** Post COVID-19 condition (PCC) and persistent physical symptoms (PPS) may involve overlapping symptom presentations. We examined whether symptom-related dimensions differ or overlap between PCC and functional somatic disorders by comparing Somatic Symptom Disorder–B Criteria Scale (SSD-12; cognitive-affective distress) and the Patient Health Questionnaire-15 (PHQ-15; somatic symptom burden), and by performing a joint factor analysis of their items.

**Methods:** Two cohorts at Helsinki University Hospital were analysed: the Sympa cohort (2020–2024), comprising patients with PPS, and the Long Covid (LC) cohort (2021–2023), including patients with PCC and age- and sex-matched controls.

**Results:** The study included 557 patients with PPS, 433 with PCC, and 197 controls; two-thirds of patients in both cohorts were female. Patients showed markedly higher somatic symptom burden than controls, with 52.2% of patients with PPS and 48.0% of those with PCC exceeding the combined SSD-12 and PHQ-15 threshold indicating concurrent high somatic symptom burden and symptom-related distress. Joint factor analysis revealed a four-factor structure: one dominant cognitive-affective distress factor; a narrower persistence-worry factor; and two symptom clusters reflecting pain/gastrointestinal and autonomic-neurological symptoms. Participants above the threshold had poorer quality of life, lower resilience, and more comorbidities and symptoms across cohorts (all  $p < 0.001$ ).

**Conclusions:** Approximately half of rehabilitation clinic patients with PPS or PCC exhibited high somatic symptom burden and symptom-related distress. Despite differing clinical entry points, the two cohorts showed broadly similar symptom-related dimensions. High symptom-related distress identifies a subgroup with greater impairment who may benefit from targeted rehabilitation approaches.

## 1. Introduction

Persistent physical symptoms (PPS) that cannot be fully explained by structural or biochemical pathology are common in both primary and specialist care [1]. PPS is used here as a descriptive umbrella term referring to long-lasting and distressing bodily symptoms, irrespective of etiology or diagnostic classification. Such presentations—often discussed within frameworks such as functional disorders, somatic symptom disorder (SSD), or PPS—share core features including multiple or distressing symptoms, high health care utilization, and reduced quality of life [2,3].

These terms operate at different conceptual levels. Functional disorders refer to syndromic clinical entities characterized by persistent symptoms and functional impairment, typically in the absence of sufficient structural pathology. Somatic Symptom Disorder (SSD) is a formal DSM-5 psychiatric diagnosis, and Bodily Distress Disorder its ICD-11 counterpart, emphasizing symptom-related distress, preoccupation, and maladaptive responses rather than the medical explanation of symptoms. These frameworks are overlapping but not interchangeable, and patients in clinical practice may meet criteria across more than one descriptive or diagnostic category.

The COVID-19 pandemic has renewed interest in persistent symptom

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syndromes. A subset of patients develop long-lasting fatigue, pain, and cognitive complaints after SARS-CoV-2 infection, referred to as post COVID-19 condition (PCC). PCC is a post-infectious condition defined by its temporal association with SARS-CoV-2 infection and characterized by heterogeneous and fluctuating symptom presentations. Emerging evidence suggests that PCC and functional disorders may share biopsychosocial features such as altered interoception, sustained autonomic and stress activation, and heightened symptom focusing [1,4], raising questions about whether similar symptom-related dimensions operate across post-infectious and non-post-infectious clinical contexts.

DSM-5 SSD and ICD-11 Bodily Distress Disorder emphasize symptom-related distress rather than unexplained symptoms. The 12-item Somatic Symptom Disorder – B Criteria Scale (SSD-12) captures cognitive-affective dimensions [5,6], while the 15-item Patient Health Questionnaire (PHQ-15) quantifies somatic symptom burden. Together, these instruments allow assessment of two core dimensions: the extent of somatic symptom burden and the degree of associated cognitive-emotional distress. A combined criterion (SSD-12  $\geq$  23 and PHQ-15  $\geq$  9) has been proposed to identify individuals with concurrently high symptom burden and distress [6,7]. Importantly, this criterion represents a dimensional symptom phenotype rather than a diagnostic proxy.

Although the combined SSD-12 and PHQ-15 criterion has been cross-sectionally validated in various populations [8–11], its behaviour across clinically distinct symptom presentations remains poorly understood. In particular, it remains unclear whether similar symptom-related dimensions are observed in post-infectious syndromes such as PCC compared with established functional disorders.

We therefore examined two prospective cohorts assessed with identical psychometric instruments: patients with PCC (LC cohort,  $n = 433$ ) and patients with functional disorders treated in a specialized rehabilitation clinic (Sympa cohort,  $n = 557$ ), alongside age- and sex-matched controls ( $n = 197$ ) to the LC cohort. The cohorts were defined by clinical context rather than by diagnostic criteria, allowing comparison of symptom-related dimensions across heterogeneous but clinically adjacent populations.

The aims of this study were to examine the prevalence and correlates of the combined SSD-12 and PHQ-15 criterion in patients with PCC, functional disorders, and controls, and to perform a joint factor analysis of all 27 items to identify shared latent symptom domains dimensions. By adopting a dimensional, symptom-focused approach, the study seeks to inform more nuanced assessment and rehabilitation strategies for patients with persistent physical symptoms.

## 2. Patients and methods

### 2.1. Study patients

The first Finnish tertiary rehabilitation clinic dedicated to persistent somatic symptoms was established at Helsinki University Hospital in 2019, which also marked the beginning of the Sympa cohort study launched in March 2020. Recruitment continued until the end of 2024, and follow-up was concluded in the end of 2025.

A rehabilitation clinic for patients with PCC was established in June 2021. The LC cohort study began in July 2021 and recruited participants until October 2023. Given observed similarities with the Sympa cohort, the LC study employed largely parallel procedures.

All consecutive patients attending either rehabilitation clinic were invited to participate. Referrals originated from primary health care and other hospital departments. Both cohorts enrolled adults ( $\geq 18$  years) referred by physicians who judged that the patient's symptoms were not adequately explained by an identifiable somatic or psychiatric disease. Most Sympa participants had already undergone comprehensive diagnostic evaluations before referral, and no further investigations were carried out at the rehabilitation clinic. In contrast, all patients with PCC completed a standardized set of laboratory tests according to the Finnish

national guidelines for chronic fatigue [12]. The patients in the LC cohort had all been referred to tertiary care because of PCC, and other potential causes for the symptoms had been ruled out by referring physicians. All patients were had a laboratory-confirmed COVID-19 diagnosis before the symptoms. We applied the WHO definition for post COVID-19 and use the term post COVID-19 condition in accordance with the WHO definition, while also acknowledging the commonly used term “long COVID” in our cohort contexts [13].

The controls to the LC cohort also had a laboratory or at-home over-the-counter diagnostic test confirming SARS-CoV-2 infection in 2022, and they had recovered normally. They were recruited from another outpatient COVID-19 study cohort at HUS [14], via social media advertisements, and via personal contacts of HUS Clinic for Long-Term Effects of COVID-19 staff. The controls were recruited to match the in age (age groups 18–45 years and 46 years or over) and gender.

Admission to both clinics required mutual agreement between the referring and receiving physicians that the patient's condition was not explained by a somatic or psychiatric condition and that the patient retained sufficient functional capacity to participate in rehabilitation. Consequently, the cohorts consisted mainly of working-age individuals with moderately severe symptom burden requiring tertiary-level outpatient support. During the acute phase of COVID-19, most patients with PCC had been treated in primary care, and only about 9% had required hospitalization [15].

Exclusion criteria comprised conditions that made participation impractical, such as being bedridden or having a severe psychiatric disorder that prevented participation in rehabilitation and questionnaire completion. The questionnaires were available only in Finnish, which limited participation among non-Finnish-speaking patients.

### 2.2. Cohort context and comparability

Both the Sympa and LC cohorts were recruited from tertiary rehabilitation clinics at Helsinki University Hospital, serving patients with persistent, functionally impairing symptoms referred after standard diagnostic evaluation. Although the cohorts differ in etiological entry point (non-post-infectious persistent symptoms vs. post-SARS-CoV-2 infection), they occupy a comparable position within the healthcare system, reflecting similar referral thresholds, symptom severity, and rehabilitation needs. Consequently, comparisons in this study focus on symptom-related dimensions rather than etiological classification.

### 2.3. Standard protocol approvals and patient consent

The Helsinki University Hospital Research Ethics Committee approved the Sympa cohort on November 13, 2019 (approval ID: HUS/2188/2019), and the LC cohort on June 3, 2021 (approval ID: HUS/1493/2021).

Protocol version 1.0 and trial registration data for both cohort studies are available on [www.clinicaltrials.gov](http://www.clinicaltrials.gov). The Sympa cohort is registered under NCT04667611 and the LC cohort under NCT05699512.

### 2.4. Study variables

The studied variables, identical between Sympa and LC cohorts, are described in detail in a protocol paper [16]. Patient-reported baseline data were obtained prior to the initial rehabilitation clinic visit. The primary outcomes in this study are symptom-related distress (defined as symptom-related thoughts, feelings and behaviours) measured by SSD-12 and somatic symptom severity and number measured by PHQ-15.

Somatic Symptom Disorder B Criteria Scale [5] is a brief self-report questionnaire used to assess the B criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) somatic symptom disorder, that is, the patients' perceptions of their symptom-related thoughts, feelings and behaviours.

Patient Health Questionnaire-15 (PHQ-15) [17] is a somatic

symptoms subscale derived from a self-administered version of the Primary Care Evaluation of Mental Disorders (PRIME-MD) diagnostic instruments for common mental disorders.

In the absence of published validation studies for the Finnish versions of SSD-12 and PHQ-15, we report internal consistency estimates from the present sample.

The combined SSD-12  $\geq 23$  and PHQ-15  $\geq 9$  threshold was used as a screening-level indicator of concurrent high somatic symptom burden and symptom-related distress, corresponding to core dimensions emphasized in SSD frameworks, but not intended to establish a formal psychiatric diagnosis.

The combined criterion has been proposed as a pragmatic screening approach in prior work [7]. Although SSD-12 and PHQ-15 were developed to assess distinct but related dimensions of symptom experience, their joint analysis allows examination of whether symptom burden and symptom-related distress form separable or overlapping latent domains in patients with persistent symptoms.

To measure quality of life (QoL), we used the EUROHIS-QoL-8, an 8-item index that is a shortened version of the World Health Organization (WHO) QoL Instrument [18]. This index covers eight items (overall QoL, general health, energy, daily life activities, self-esteem, social relationships, finances, and living area). The EUROHIS-QoL-8 summary score is calculated as the mean of the eight item scores (each ranging from 1 to 5). In the absence of official cut-off values, summary scores  $\geq 4$  are typically considered to indicate a good QoL in population studies. Additionally, we measured health-related QoL using 15D, a validated 15-item self-reported questionnaire [19]. The 15D is a comprehensive, generic instrument to assess physical, mental, and social well-being on 15 questions, producing a single index score ranging from 0 (equivalent to being dead) to 1 (full health) [19]. A difference of 0.015 or more in the 15D score is typically considered clinically significant [20].

Resilience was measured by RS-14, which is a short form of the Resilience Scale that measures a person's relatively stable resilience, understood as a positive trait supporting coping, adaptation and acceptance of self and life [21].

Patients were classified as having tertiary education if they selected either a university or a tertiary college in a multiple-choice question. An open-ended question asked about living arrangements, marital status, and children. Data entry clerks summarized these responses to find patients living alone. Employment status was determined if patients indicated full-time or part-time employment in a multiple-choice question at baseline. Body mass index (BMI) was based on self-reported weight and height at baseline.

The physicians at the rehabilitation outpatient clinic were primarily general practitioners and applied a comprehensive biopsychosocial approach. They documented comorbid conditions in the medical records and could adjust treatments, such as medication relevant for the symptoms (e.g. antidepressants, beta blockers), when deemed necessary.

In addition, for these cohort studies, comorbidities were identified using health registries from the Helsinki Uusimaa Hospital district (HUS) Datalake. The Datalake covers the health registers of a population of 1.7 million (specialist care and emergency room services). Patients were considered to have a comorbidity if their patient record in HUS Datalake contained any of the specified ICD-10 (International Statistical Classification of Diseases and Related Health Problems 10th Revision) codes between January 1, 2017, and 90 days after their enrolment. The list of comorbidities investigated is in the Appendix 1. (See Table 1.)

## 2.5. Statistical methods

Group comparisons of continuous variables were performed using Welch's *t*-tests for normally distributed continuous data and Mann-Whitney *U* tests for non-normally distributed continuous data. Categorical variables were analysed using chi-squared tests. A *p*-value  $< 0.05$  was considered statistically significant. For simplicity, all continuous

**Table 1**  
Baseline characteristics of study participants by cohort.

	Sympa Cohort	LC Cohort	Controls	p-value (Sympa/LC)
Total N (% of total)	557 (100)	433 (100)	197 (100)	
Female, N (%)	363(66.5)	305(70.4)	149 (75.6)	0.21
Age (years), Mean (SD <sup>a</sup> )	38.7 (11.0)	44.9 (11.3)	44.9 (10.5)	<0.001
Body Mass Index (kg/m <sup>2</sup> ), Mean (SD)	25.7 (5.5)	27.4 (5.8)	27 (5.6)	<0.001
Symptom duration (years), Median (IQR)	2.43 (1.4, 5.2)	0.71 (0.49, 1.1)	NA	<0.001
Number of comorbidities, Mean (SD)	1.7 (1.5)	1.33 (1.54)	0.68 (1.17)	<0.001
Monthly doses of alcohol, Mean (SD)	7.0 (9.9)	7.11 (9.56)	7.88 (9.3)	0.86
Number of symptoms, Mean (SD)	19.8 (8.1)	20.3 (6.71)	6.19 (5.22)	0.29
EUROHIS-QOL <sup>b</sup> , Mean (SD)	2.94 (0.7)	3.1 (0.6)	4.3 (0.5)	<0.001
QOL-15D <sup>c</sup> , Mean (SD)	0.74 (0.11)	0.76 (0.10)	0.94 (0.06)	0.002
At least one comorbidity, N (%)	422(77.0)	266(61.6)	66(39.8)	<0.001
Employed, N (%)	249(44.7)	297(68.6)	175 (88.8)	<0.001
Tertiary education, N (%)	295(53.6)	247(58.1)	148 (75.1)	0.183
Only basic education, N (%)	100(18.2)	18(4.24)	3(1.52)	<0.001
Living alone, N (%)	79(14.2)	117(27)	45(22.8)	<0.001
Current smoking, N (%)	50(9.1)	30(7.0)	13(6.7)	0.28

Patients with persistent physical symptoms (Sympa cohort), patients with Long Covid (LC cohort), and age- and sex-matched controls. This table addresses cohort-level comparisons independent of SSD-12 and PHQ-15 threshold status.

<sup>a</sup> SD = standard deviation.

<sup>b</sup> EUROHIS-QOL scale 1–5.

<sup>c</sup> S15D scale 0–1.

variables were reported as means with standard deviation (SD) whereas categorical variables were reported as frequencies with percentages. Internal consistency of SSD-12 and PHQ-15 was assessed using Cronbach's alpha.

To explore the joint latent structure underlying the SSD-12 and PHQ-15 scales, we conducted an exploratory factor analysis (EFA) including all 27 items from both instruments. The analysis was performed on the combined sample of patients with PCC and those with functional somatic disorders, using diagonally weighted least squares with mean and variance adjustment (WLSMV) estimation.

Factor extraction employed principal axis factoring with oblique (oblimin) rotation, allowing for correlated factors. Items were assigned to the factor on which they had the highest loading ( $> 0.30$ ), items were only allowed to load on one factor for clarity.

Solutions with up to 6 factors were visually inspected to find explanatory value. The chosen solution was subsequently used to visualize the latent relationships between items using a path diagram, where the paths between items and factors represent factor loadings, and paths between factors represent factor correlations.

The number of factors was evaluated using parallel analysis, which indicated a maximum of seven factors. Exploratory factor models with 1–7 factors were estimated using WLSMV. Model fit was assessed using CFI, TLI, RMSEA, and SRMR. Solutions with fewer than three factors showed inadequate fit (CFI  $< 0.90$ ) and were excluded. Among the remaining solutions, the most parsimonious and interpretable model was selected based on overall fit and conceptual clarity.

Statistical analyses were conducted using R statistical computing environment version 4.5.0 (R Core Team, 2016. R: A language and environment for statistical computing. R Foundation for Statistical

Computing, Vienna, Austria. <https://www.R-project.org/>).

### 3. Results

#### 3.1. Study -participants

Fig. 1 presents the patient recruitment in the two study cohorts. In both rehabilitation clinics, approximately half of the referrals were approved. Table 1 summarizes the sociodemographic and clinical characteristics of the patients recruited to the study cohorts. Both the Sympa ( $n = 557$ ) and LC ( $n = 433$ ) cohorts were predominantly female (66.5% and 70.4%, respectively). Participants with LC were on average older ( $45 \pm 11$  years,  $p < 0.001$ ) than those in the Sympa cohort ( $39 \pm 11$  years).

#### 3.2. Sympa versus LC

Compared with the LC cohort, the Sympa cohort showed a markedly longer symptom duration ( $5.1 \pm 6.7$  vs.  $0.9 \pm 0.6$  years,  $p < 0.001$ ) and a higher burden of comorbidities (mean  $1.7 \pm 1.5$  vs.  $1.3 \pm 1.5$ ,  $p < 0.001$ ) (Table 1). Employment and tertiary education were less common among Sympa participants than among patients with LC (44.7% vs. 68.6% employed; 53.6% vs. 58.1% with tertiary education). Quality of life (QoL), assessed using the EUROHIS-QoL-8, was lower in the Sympa cohort than in the LC cohort ( $2.9 \pm 0.7$  vs.  $3.1 \pm 0.6$ ,  $p < 0.001$ ). Similar differences were observed with the 15D instrument, with lower QoL in the Sympa cohort compared with the LC cohort ( $0.74 \pm 0.11$  vs.  $0.76 \pm 0.11$ ,  $p = 0.002$ ).

#### 3.3. LC versus controls

Compared with controls, patients with LC had a higher number of comorbidities ( $1.3 \pm 1.5$  vs.  $0.7 \pm 1.2$ ) and substantially lower QoL, as measured by both the EUROHIS-QoL-8 ( $3.1 \pm 0.6$  vs.  $4.3 \pm 0.5$ ) and the 15D ( $0.76 \pm 0.11$  vs.  $0.94 \pm 0.06$ ) (Table 1). Employment and tertiary education were more common among controls (88.8% and 75.1%,

respectively) than among patients with LC. Living alone was more frequent in the LC cohort than among controls (27.0% vs. 22.8%).

#### 3.4. Distribution of SSD-12, PHQ-15 and their combination in the study cohorts

Fig. 2 illustrates the distributions of SSD-12, PHQ-15, and their combined total scores across study groups. Controls consistently showed right-skewed distributions concentrated at the lower end of each scale, indicating minimal somatic symptom burden. Both patient cohorts demonstrated distinctly higher and wider distributions, with the Sympa group showing the highest overall symptom burden and the broadest variability. Internal consistency was good for both instruments (PHQ-15  $\alpha = 0.83$ ; SSD-12  $\alpha = 0.90$ ).

More patients fulfilled the PHQ-15 criterion,  $PHQ-15 \geq 9$ , (78.8% in LC, 75.4% in Sympa) than the SSD-12 criterion,  $SSD-12 \geq 23$ , (53.3% in LC, 61.6% in Sympa) (Fig. 2, panels A and B). Of the controls, 8.6% fulfilled the PHQ-15 criterion, and 4.1% the SSD-12 criterion.

For PHQ-15, the LC group peaked at moderate severity (scores of 10–15) and the Sympa group extended toward the maximum range. The combined index (Fig. 2, panel C) further accentuated these contrasts, with a clear rightward shift among both patient cohorts and a large proportion exceeding the clinical threshold for SSD, while such cases were rare among healthy controls (2.5% of controls fulfilled the combined SSD-12 and PHQ-15 criterion).

#### 3.5. Comparison of participants below and above the combined SSD-12 and PHQ-15 threshold

Table 2 compares the sociodemographic and clinical characteristics of participants scoring below and above the combined SSD-12 and PHQ-15 threshold within both patient cohorts. In both cohorts, participants with higher symptom burden showed markedly poorer functional ability and QoL, lower resilience, and a greater number of symptoms and comorbidities (all  $p < 0.001$ ). These participants also had significantly higher rates of anxiety disorder diagnoses than those with lower

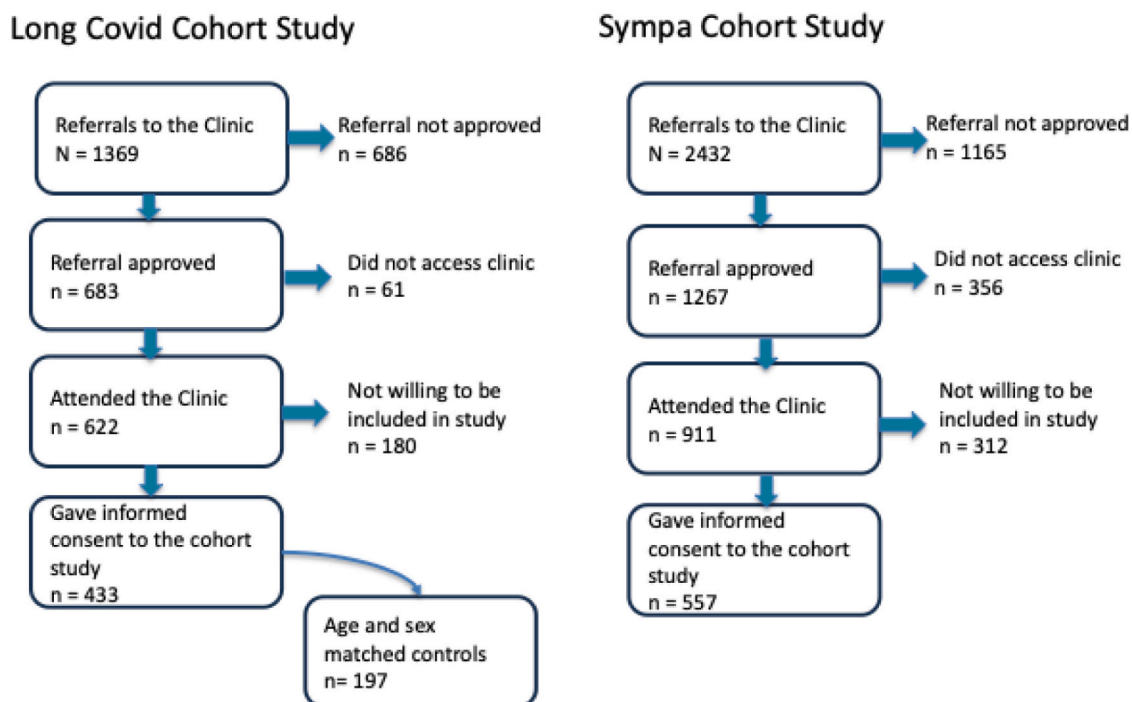
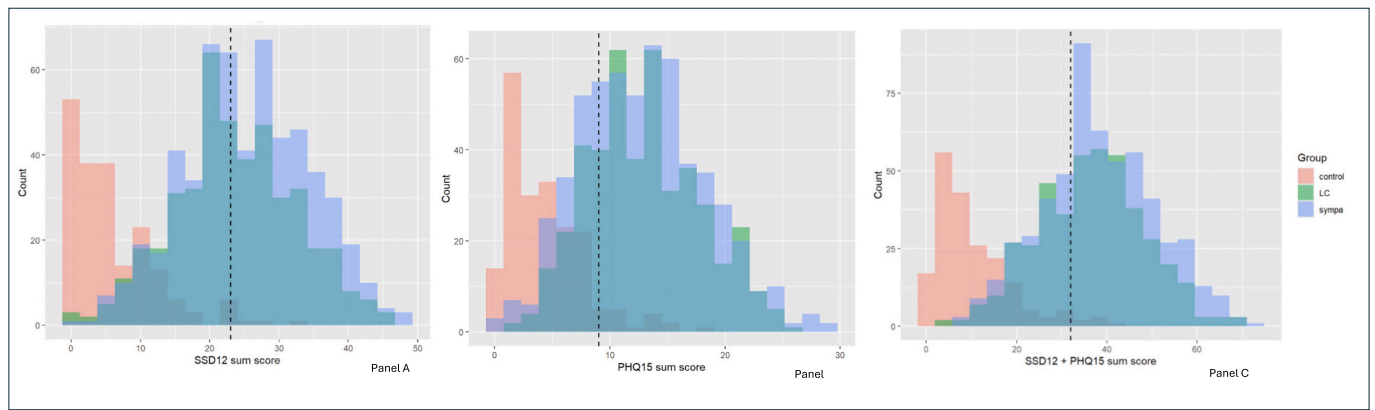


Fig. 1. Patient recruitment and cohort formation for the Long Covid (LC) and persistent physical symptom (Sympa) cohorts. This figure illustrates cohort assembly for the primary cohort-level comparisons between LC, PPS, and controls.



**Fig. 2.** Distribution of SSD-12 (panel A), PHQ-15 (panel B) and the combined SSD-12 and PHQ-15 (panel C) total scores across study groups. The dashed vertical line indicates the proposed clinical cut-off ( $\geq 23$  for clinically relevant somatic symptom burden (panel A), the clinical cut-off ( $\geq 9$ ) for at least moderate somatic symptom severity, and the approximate threshold for clinically relevant total somatic symptom burden (panel C). This figure illustrates cohort-level differences between LC, PPS, and controls, and visualizes the position of the proposed clinical thresholds used for subsequent subgroup analyses.

**Table 2**  
Threshold-based subgroup comparisons within cohorts according to combined SSD-12 and PHQ-15 status.

	All in LC Cohort	SSD12 and PHQ15 below threshold	SSD12 and PHQ15 above threshold	p-value	All in Sympa cohort	SSD12 and PHQ15 below threshold	SSD12 and PHQ15 above threshold	p-value
total N (% of total)	433(68.7)	225(52)	208(48)	NA	557(100.0)	266(47.8)	291(52.2)	NA
Female, N (%)	305(70.4)	158(70.2)	147(70.7)	1	363(66.5)	171(64.8)	192(68.1)	0.42
Age (years) Mean (SD)	44.9 (11.3)	44.9 (11.3)	44.8 (11.3)	0.94	38.7 (11.0)	39.3 (10.9)	38.2 (11.0)	0.23
BMI (kg/m <sup>2</sup> ) Mean (SD)	27.4 (5.8)	27.4 (5.5)	27.4 (6.2)	0.65	25.7 (5.5)	25.5 (5.4)	25.8 (5.5)	0.44
0–10 Functional ability Mean (SD)	4.79 (2.1)	5.35 (2.01)	4.18 (1.9)	< 0.001	4.6 (1.9)	5.1 (1.9)	4.2 (1.7)	< 0.001
0–10 Quality of life Mean (SD)	5.11 (2.1)	5.72 (2.0)	4.43 (2.0)	< 0.001	5.0 (2.0)	5.8 (1.9)	4.4 (1.9)	< 0.001
Symptom duration (years) Median (IQR)	0.71 (0.5, 1.1)	0.69 (0.5, 1.1)	0.73 (0.5,1.2)	0.64	2.4 (1.4, 5.2)	2.4 (1.3, 5.6)	2.5 (1.4, 5.0)	0.98
Number of comorbidities Mean (SD)	1.3 (1.5)	1.1 (1.5)	1.53 (1.5)	< 0.001	1.7 (1.5)	1.4 (1.4)	2.0 (1.6)	< 0.001
Monthly doses of alcohol Mean (SD)	7.11 (9.6)	7.8 (10.3)	6.3 (8.6)	0.11	7.0 (9.9)	6.5 (8.5)	7.4 (11.1)	0.66
Number of symptoms Mean (SD)	20.3 (6.7)	17.9 (6.4)	23 (6.1)	< 0.001	19.8 (8.1)	15.6 (7.1)	23.6 (6.9)	< 0.001
EuroHIS QoL Mean (SD)	3.1 (0.62)	3.3 (0.56)	2.8 (0.57)	< 0.001	2.9 (0.7)	3.2 (0.6)	2.7 (0.6)	< 0.001
QoL-15D Mean (SD)	0.76 (0.10)	0.81 (0.08)	0.71 (0.10)	< 0.001	0.74 (0.11)	0.79 (0.09)	0.69 (0.10)	< 0.001
Resilience 14 Mean (SD)	73.4 (16.4)	78 (14.4)	68.5 (17.1)	< 0.001	66.2 (18.0)	72.9 (16.5)	61.4 (17.5)	< 0.001
Employed N (%)	297(68.6)	164(72.9)	133(63.9)	0.055	249(44.7)	128(48.1)	121(41.6)	0.14
Tertiary education N (%)	247(58.1)	136(61.8)	111(54.1)	0.11	295(53.6)	148(56.9)	147(50.7)	0.14
Living alone, N (%)	117(27)	56(24.9)	61(29.3)	0.33	79(14.2)	44(16.5)	35(12.0)	0.14
Smoking, N (%)	30(7.04)	13(5.86)	17(8.33)	0.36	50(9.1)	17(6.5)	33(11.6)	0.05
Participated in at least one group therapy session at the clinic N (%)	74(17.1)	24(10.7)	50(24)	0.001	117(21.0)	38(14.3)	79(27.1)	< 0.001
Asthma N (%)	72(16.7)	31(13.8)	41(19.8)	0.13	60(10.9)	28(10.7)	32(11.1)	0.89
Back_or_Neck_Disease N (%)	48(11.1)	21(9.33)	27(13)	0.28	82(15.0)	40(15.3)	42(14.6)	0.91
Anxiety_Disorder N (%)	51(11.8)	17(7.56)	34(16.4)	0.004	185(33.8)	62(23.8)	123(42.9)	< 0.001

Clinical and psychosocial characteristics of patients with Long Covid (LC) and persistent physical symptoms (Sympa), stratified by whether they meet the combined SSD-12 and PHQ-15 threshold for clinically relevant somatic symptom burden and symptom-related distress.

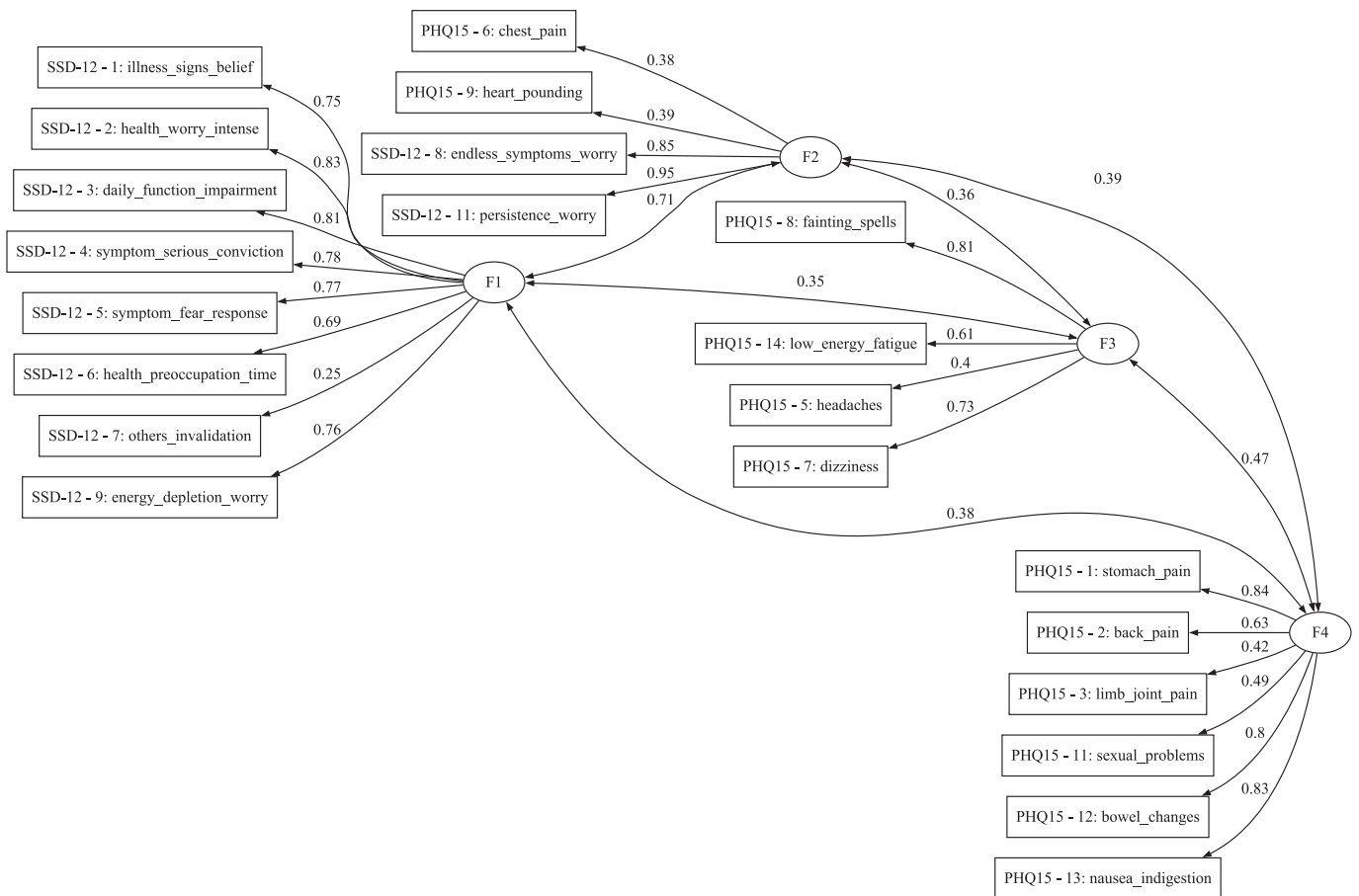
symptom burden (LC 16.4% vs 7.6%,  $p = 0.004$ ; Sympa 42.9% vs 23.8%,  $p < 0.001$ ).

No significant group differences were observed for sex, age, body-mass index, or alcohol use. Educational attainment and employment tended to be lower among those above the threshold, although these trends did not reach statistical significance. In both cohorts, participation in group therapy sessions at the clinic was substantially more common among participants with high symptom burden (LC 24.0% vs 10.7%,  $p = 0.001$ ; Sympa 27.1% vs 14.3%,  $p < 0.001$ ).

### 3.6. Factor analysis

The combined factor analysis of all SSD-12 and PHQ-15 items suggested up to seven factors. Solutions with fewer than three factors showed poor fit (CFI < 0.90). Among the remaining models, a four-factor solution provided the most parsimonious and interpretable structure (Fig. 3):

- Factor 1 (F1) comprised all broad SSD-12 cognitive-emotional distress items, capturing symptom-related worry, catastrophic



**Fig. 3.** Joint factor analysis of all SSD-12 and PHQ-15 items in patients with post COVID-19 and persistent physical symptoms. Four latent factors were identified: Factor 1 (F1) represented cognitive-emotional symptom distress (core SSD-12 dimension), Factor 2 (F2) represented symptom persistence and worry (a narrower SSD-12 subdimension), Factor 3 (F3) captured pain and gastrointestinal symptoms (PHQ-15), and Factor 4 (F4) represented autonomic/neurological symptoms (PHQ-15). Factor loadings  $\geq 0.3$  are shown. Values on the links between factors and items represent standardized factor loadings, values between factors represent factor correlations. This analysis was conducted across both patient cohorts to characterize shared latent symptom dimensions independent of cohort membership or threshold status.

interpretations, fear responses, health preoccupation, and perceived functional impairment.

- Factor 2 (F2) consisted exclusively of two SSD-12 items reflecting symptom persistence and the perception that symptoms are endless, forming a narrower persistence–worry subdimension that is psychometrically distinct from the broader cognitive-emotional factor.
- Factor 3 (F3) included PHQ-15 items representing pain and gastrointestinal symptoms, while
- Factor 4 (F4) represented autonomic and neurological PHQ-15 symptoms such as dizziness, palpitations, headaches, and faintness.

Notably, no PHQ-15 items loaded on F2, indicating that the persistence–worry dimension was specific to cognitive-emotional appraisal and not directly tied to somatic symptom type or intensity. The four-factor structure indicates that persistent symptom presentations center on a dominant cognitive–emotional domain, complemented by distinct somatic symptom clusters, reflecting the interplay between psychological processes and physical symptoms.

To further contextualize our findings, we conducted confirmatory factor analyses comparing our results with previously published models. The original SSD-12 three-factor model [6] showed poor fit in our data (RMSEA = 0.117), whereas the PHQ-15 bifactor model [22] showed acceptable fit (RMSEA = 0.060). The model obtained by EFA for the combination of SSD-12 and PHQ-15 showed acceptable fit (RMSEA = 0.054). The detailed fit indices are provided in Supplementary Table.

#### 4. Discussion

The distributions of SSD-12 and PHQ-15 scores were similar among patients with persistent somatic symptoms and those with PCC and differed substantially from the matched controls. Approximately half of the patients in both cohorts met the combined SSD-12 and PHQ-15 threshold corresponding to the DSM-5 somatic symptom disorder criteria, while only 2.5% of controls fulfilled the criterion. The participants above the clinical threshold reported significantly poorer quality of life, lower resilience, and had more comorbidities—particularly anxiety—as well as a higher overall symptom burden. Participants in the Sympa cohort exhibited a higher prevalence of diagnosed anxiety disorder than those in the LC cohort (33.7% vs. 8.8%), potentially reflecting longer symptom duration.

The combined SSD-12 and PHQ-15 criterion proposed by Toussaint et al. offers a standardized method for identifying clinically significant somatic symptom distress [5]. Patients meeting the threshold often represent a vulnerable subgroup with multiple biopsychosocial contributing factors [23–25]. It is therefore important that clinicians approach these individuals holistically and aid them in recognising relevant psychological, behavioural, and contextual factors that offer opportunities for targeted rehabilitation approaches beyond mere symptom regulation.

Overall, the gradient observed across the combined SSD-12 and PHQ-15 scores indicates a consistent association with greater somatic symptom load, poorer self-rated functioning, and reduced psychosocial

well-being in both cohorts. The four-factor structure observed in this study provides additional insight into the organization of persistent symptom presentations across both cohorts. This structure is consistent with findings from our earlier LC cohort study [15], where symptom-based cluster analysis revealed comparable groupings of fatigue, cognitive difficulties, pain, autonomic symptoms, and emotion-related symptoms, pointing toward shared organizational patterns of persistent somatic symptoms.

Previous research has shown that the PHQ-15 can be described with a bifactor structure, consisting of a dominant general somatic symptom burden factor alongside several symptom-specific factors [22]. Recent evidence [11] suggests that the factor structure of the SSD-12 may vary across populations, supporting the use of exploratory approaches in this context.

The broad cognitive-emotional distress factor (F1) aligns with contemporary diagnostic frameworks emphasizing the interplay between physical symptoms and psychological processes—such as perception, interpretation, preoccupation, and distress—all modulated by central regulatory mechanisms of the nervous system [26–29]. A narrower persistence–worry factor (F2), consisting solely of two SSD-12 items, suggests that perceptions of chronicity and “endlessness” represent a distinct psychological dimension potentially relevant for identifying patients at risk for prolonged symptoms. In contrast, somatic symptoms separated into differentiated clusters—pain and gastrointestinal symptoms (F3) and autonomic–neurological symptoms (F4)—indicate that symptom types remain meaningfully organized despite substantial overall overlap.

The absence of PHQ-15 item loadings on the persistence–worry factor (F2) underscores that cognitive-emotional appraisal is not merely a reflection of symptom type or intensity but constitutes a distinct latent domain. The consistency of this structure across two clinically different cohorts suggests that similar mechanisms may underlie symptom maintenance in both LC and established functional disorders. These findings argue for assessment approaches that integrate both cognitive-emotional and somatic dimensions when evaluating patients with persistent symptoms.

Assigning diagnostic labels to individuals with PPS remains challenging. In the ICD-10 system currently used in Finland, patients often receive etiology- or body-region-specific diagnoses, such as chronic fatigue syndrome (G93.3), irritable bowel syndrome (K58), fibromyalgia (M79.7), or nonspecific symptom codes such as R68.88 (‘other general symptoms and signs’). These labels do not capture the psychological and behavioural dimensions emphasized in the DSM-5 Somatic Symptom Disorder and ICD-11 Bodily Distress Disorder frameworks, which more accurately reflect the biopsychosocial nature of these conditions.

Our findings are consistent with reports from German specialty clinics, where only about half of patients meet the combined SSD-12 and PHQ-15 criterion [30]. This indicates that not all patients with multiple or disabling symptoms show the cognitive-emotional over-engagement characteristic of DSM-5 Criterion B. Population- and language-specific cut-off variation should also be considered when applying the criterion clinically [10,31,32].

The subgroup meeting the SSD criterion—characterized by marked symptom-related distress and preoccupation—likely represents patients most in need of targeted rehabilitation. The combined criterion may therefore help guide rehabilitation planning and identify patients who would benefit from interventions targeting symptom interpretation, coping behaviour, and functional restoration [33]. In our study, patients meeting the threshold for SSD indeed received more rehabilitation-oriented interventions, including group programmes and internet-based therapies, underscoring the clinical relevance of identifying this subgroup.

A major strength of this study is the use of two clinically well-characterized patient cohorts assessed with identical psychometric instruments, alongside an age- and sex-matched control group of the LC cohort. This parallel design allowed a direct comparison of symptom

burden and cognitive-emotional distress between PCC and other PPS conditions. The systematic exclusion of somatic causes through clinical evaluation increases the reliability of symptom characterisation, and the use of validated PROMs (SSD-12, PHQ-15, EUROHIS-QoL-8, 15D, and RS-14) strengthens the assessment of both symptom severity and broader psychosocial functioning. The joint exploratory factor analysis across both cohorts provides a methodologically robust examination of latent symptom structure, offering insight into patterns of symptom covariance that may extend across different persistent symptom presentations.

Several limitations should be considered. First, patients referred to a rehabilitation clinic constitute a selected subgroup; referral decisions were influenced by recovery potential, multimorbidity and functional status, which may limit generalisability. Second, the educational level in both cohorts was higher than in the Finnish general population, indicating potential socioeconomic selection bias [23]. Third, all measures were based on self-report, and socioeconomic variables were not comprehensively captured. The threshold values of SSD-12 and PHQ-15 were applied to address the research question but have not been formally validated in the Finnish population and should therefore be interpreted with caution, particularly as their sensitivity and specificity for diagnosing SSD remain unknown. Thus, the combined SSD-12 and PHQ-15 criterion should be considered a screening-based indicator of symptom-related distress rather than a diagnostic classification. In addition, questionnaires were available only in Finnish, which likely reduced participation among immigrants.

Finally, the cross-sectional design prevents inference about causality or temporal relationships between symptom burden, cognitive-emotional distress, and functional outcomes. In addition, while both the PHQ-15 and SSD-12 have well-established instrument-specific factor structures, the present study adopted an exploratory approach to characterize the joint latent symptom space across instruments and cohorts. Formal confirmatory testing of combined measurement models and measurement invariance across cohorts was beyond the scope of this analysis. Future longitudinal analyses are needed to examine whether the identified latent domains predict clinical trajectories.

In summary, patients with PCC and those with other PPS displayed highly similar SSD-12 and PHQ-15 profiles, suggesting a largely comparable clinical presentation. Understanding these symptom profiles—and the latent factors underlying them—may enable clinicians to recognise central regulatory processes and tailor interventions more precisely. Future research should examine the prognostic significance of the SSD-12 and PHQ-15 construct, including whether distinct subgroups with different trajectories or treatment needs can be identified. Such work has the potential to improve stratification, guide personalised rehabilitation, and ultimately enhance outcomes for patients with persistent somatic symptoms.

#### CRediT authorship contribution statement

**Helena Liira:** Writing – original draft, Resources, Methodology, Funding acquisition, Conceptualization. **Mikko Varonen:** Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation. **Velina Vangelova-Korpinen:** Writing – original draft, Investigation. **Mikko S. Venäläinen:** Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Jari Arokoski:** Writing – original draft, Supervision, Investigation, Funding acquisition, Conceptualization. **Kirsi Kvarnström:** Writing – original draft, Resources, Project administration, Data curation. **Aki Vuokko:** Writing – original draft, Investigation, Conceptualization. **Antti Malmivaara:** Writing – original draft, Supervision, Methodology, Investigation, Conceptualization.

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## Declaration of competing interest

Helena Liira has received honorariums for lectures and workshops about persistent physical symptoms and long Covid. The remaining authors declare no conflicts of interest relating to this manuscript.

## Appendix A

### Appendix 1

The list of comorbidities investigated is in the study. Patient were considered to have a comorbidity if their patient record in HUS Datalake contained any of the regular expressions with specified ICD-10 codes between January 1, 2017, and 90 days after their enrolment.

Celiac.Disease	^K90
Hypothyroidism	^E03
Hyperthyroidism	^E05
Diabetes	^E1[01]
Rheumatoid.Arthritis	^M06
Rheumatoid.Arthritis..Joints.	^M05
Psoriasis	^L40
Asthma	^J45
Chronic.Obstructive.Pulmonary.Disease	^J44
Sjögren.s.Syndrome	^M35\0.0
Systemic.Lupus.Erythematosus	^M32
Ulcerative.Colitis	^K51
Crohn.s.Disease	^K50
Uveitis	^H20
Optic.Neuritis	^H46
Multiple.Sclerosis	^G35
Epilepsy	^G40
Parkinson.s.Disease	^G20
Syncope	^R55
Convulsion	^R56
Myelitis	^G37
Pernicious.Anemia	^D51\0.0
Immune.Thrombocytopenic.Purpura	^D69\0.3
Cancer	^C
Hypertension	^I10
Cardiac.Arrhythmia	^I49
Coronary.Artery.Disease	^I25\0.1
Myocarditis	^I51\0.4
Kidney.Failure	^N18
Liver.Failure	^K72
Irritable.Bowel.Syndrome	^K58
Depression	^F32
Panic.Disorder	^F41\0.0
Anxiety.Disorder	^F41
Back.or.Neck.Disease	^(M51 M54 M53 M50 M41)
Osteoarthritis	^M15
IBD	^K5[0-2]\.

## Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychores.2026.112686>.

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