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COVID-19 illness severity and 2-year prevalence of physical symptoms: an observational study in Iceland, Sweden, Norway and Denmark

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Summary

Background Although the persistence of physical symptoms after SARS-CoV-2 infection is a major public health concern, evidence from large observational studies beyond one year post diagnosis remain scarce. We aimed to assess the prevalence of physical symptoms in relation to acute illness severity up to more than 2-years after diagnosis of COVID-19.

Methods This multinational study included 64,880 adult participants from Iceland, Sweden, Denmark, and Norway with self-reported data on COVID-19 and physical symptoms from April 2020 to August 2022. We compared the prevalence of 15 physical symptoms, measured by the Patient Health Questionnaire (PHQ-15), among individuals with or without a confirmed COVID-19 diagnosis, by acute illness severity, and by time since diagnosis. We additionally assessed the change in symptoms in a subset of Swedish adults with repeated measures, before and after COVID-19 diagnosis.

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Findings During up to 27 months of follow-up, 34.5% participants (22,382/64,880) were diagnosed with COVID-19. Individuals who were diagnosed with COVID-19, compared to those not diagnosed, had an overall 37% higher prevalence of severe physical symptom burden (PHQ-15 score \geq 15, adjusted prevalence ratio [PR] 1.37 [95% confidence interval [CI] 1.23–1.52]). The prevalence was associated with acute COVID-19 severity: individuals bedridden for seven days or longer presented with the highest prevalence (PR 2.25 [1.85–2.74]), while individuals never bedridden presented with similar prevalence as individuals not diagnosed with COVID-19 (PR 0.92 [0.68–1.24]). The prevalence was statistically significantly elevated among individuals diagnosed with COVID-19 for eight of the fifteen measured symptoms: shortness of breath, chest pain, dizziness, heart racing, headaches, low energy/fatigue, trouble sleeping, and back pain. The analysis of repeated measurements rendered similar results as the main analysis.

Interpretation These data suggest an elevated prevalence of some, but not all, physical symptoms during up to more than 2 years after diagnosis of COVID-19, particularly among individuals suffering a severe acute illness, highlighting the importance of continued monitoring and alleviation of these targeted core symptoms.

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Keywords: Physical symptom; Long covid; Cohort; COVID-19

Research in context

Evidence before this study

As the majority of the global population has contracted COVID-19, persistence of physical symptoms after SARS-CoV-2 infection (Long COVID or post COVID-19 condition) has become a major public health concern. We searched PubMed for studies assessing physical symptoms after COVID-19, published by August 23, 2023. The search term was (physical symptoms after covid) AND LitCLONGCOVID [Pubmed filter]. We reviewed 99 studies, after excluding those not on humans or not published in English. High prevalence of multiple physical symptoms, mainly fatigue, shortness of breath, headache, muscle and chest pain, has been reported, mostly based on selected populations, samples of hospitalized patients confined to three months to one year after diagnosis. A comprehensive assessment of long-term prevalence of physical symptoms beyond one year after diagnosis and among non-hospitalized patients is lacking.

Added value of this study

We included 64,880 participants from the general population of four Nordic countries, of whom 22,382 had been diagnosed with COVID-19 up to 2 years earlier (<1% hospitalized due to COVID-19). Individuals diagnosed with COVID-19 reported a 37% higher prevalence of overall severe physical symptom burden compared to individuals not diagnosed with COVID-19. We found that shortness of breath, chest pain, dizziness, headaches, and low energy/fatigue were particularly increased among individuals with COVID-19 diagnosis. Individuals bedridden for seven days or more during the acute illness phase (9.6% of the patients) showed the greatest and most persistent elevation in prevalence of severe physical symptoms while individuals not bedridden during the acute COVID-19 illness showed no increase in prevalence of physical symptoms compared to those not diagnosed.

Implications of all the available evidence

Our findings provide timely and valuable evidence to demonstrate the constitution of Long COVID and the longterm health consequences after recovery from COVID-19 in the general population. The long-term risk of severe physical symptom burden is distinctly associated with acute illness severity, highlighting the importance of sustained monitoring of physical symptoms among the group of patients who suffered severe acute illness course.

Introduction

The COVID-19 pandemic continues to have substantial public health consequences three years after its outbreak in 2020. As of August 2023, more than 694 million individuals worldwide have been infected by the SARS-CoV-2 virus¹ and an estimated 10–20% of these

individuals will continue to experience a variety of symptoms after recovery.² The presence of long-term symptoms persisting beyond two months after infection has been recognized as *Long* COVID or post-COVID-19 condition.^{3,4} In addition to flu-like symptoms, studies suggest that other physical symptoms can

extend beyond the disease course,4-7 including fatigue,^{4,5,7} shortness of breath,^{4,7} headache,^{8,9} and myalgias and chest pain.4.8.9 Many observational studies are based on small patient samples or selected populations,10,11 with less than one year of follow-up post-diagnosis and, notably, focused on hospitalized patients.7 General population data on the prevalence of physical symptoms after COVID-19 diagnosis over a longer period of time is lacking, especially by measures of acute illness severity.^{8,9} Importantly, the absence of comparison to populations without a confirmed COVID-19 diagnosis has largely limited the interpretation of these findings.4,8,11 Also, the use of validated instruments to quantify physical symptom severity is needed because assessment of individual physical symptoms has varied greatly in the literature, 5.7.8 making it difficult for direct comparisons.

With this background, we leveraged data from four *Nordic* cohorts of the COVIDMENT Consortium¹² to investigate the prevalence of physical symptom burden up to 27 months following a COVID-19 diagnosis with a focus on analysing the severity of acute COVID-19 illness and time since diagnosis. We further utilized repeated measures of the physical symptoms to assess the change in the prevalence of physical symptoms before and after COVID-19 diagnosis in a subset of adult study participants in Sweden.

Methods

Study population and design

We included four cohorts from the COVIDMENT Consortium with data collection on physical symptoms: 1) The Icelandic COVID-19 National Resilience Cohort (C-19 Resilience), which was established in April 2020 with two waves of data collection through August 2021. All adult Icelandic and English-speaking individuals who had an Icelandic electronic ID were eligible for participation. The C-19 Resilience cohort is overrepresented by women, with a higher age and education than the general population; 2) The Swedish Omtanke2020 Study was established in June 2020, and collected monthly data on physical symptoms from July 2021 to February 2022, with yearly follow-ups thereafter. Eligible participation was all adult residents of Sweden with the electronic identification BankID. Omtanke2020 is over-representative of women, ages 40-69 years, and individuals living in an urban area; 3) The Norwegian COVID-19, Mental Health and Adherence Project (MAP-19) is a 9-wave longitudinal study initiated from March 2020, with additional information on physical symptoms collected in March 2022. It recruited adult residents across all age groups, and was found to be representative of the Norwegian adult population13; and 4) The Danish Blood Donor Study (DBDS) is an ongoing nationwide cohort study including blood doners at the time of blood donation.12 Additional questionnaires

were sent out to participants regarding long-term health changes related to COVID-19 from June to August 2022. The DBDS is slightly over-sampled by men, individuals of higher age and education. All study participants from the four cohorts provided electronic informed consent. Ethical approvals were obtained for each participating cohort from national or regional bioethics committees (Supplementary Table S1). After exclusion of study participants with incomplete information on COVID-19 diagnosis and incomplete assessment of physical symptoms, 64,880 individuals were included for further analysis: N = 14,358 from C-19 Resilience, N = 18,190from the Omtanke2020, N = 3310 from MAP-19, and N = 29,958 from the DBDS (Supplementary Figure S1 flowchart).

Data collection and assessment

COVID-19 diagnosis was assessed by self-reported SARS-CoV-2 infection from a positive RT-PCR test. Participants who reported a confirmed diagnosis of COVID-19 during the study period were referred to as the COVID group whereas the remaining participants were referred to as the non-COVID group. Time since diagnosis was defined as the time interval between the reported date of diagnosis and physical symptom data collection, and was coded as 0-2 months, 3-5 months, 6-9 months, and 10-27 months (up to 16 months in C-19 Resilience, up to 22 months in Omtanke2020, up to 24 months in MAP-19, and up to 27 months in DBDS). The illness severity during the acute phase of COVID-19 was determined by self-reported number of days confined to bed (administered options in questionnaire: not bedridden, bedridden 1-6 days, or bedridden 7 days or longer), and hospitalization due to COVID-19 infection (yes or no), in line with our previous work.14

All four cohorts used the 15-item Patient Health Questionnaire (PHQ-15) to measure the severity of physical symptoms most commonly recognized in outpatient settings. The questionnaire was harmonized and administrated in the language of the respective country of each cohort. The PHQ-15 is a widely used instrument and has been validated in different populations.15 Each symptom is scored as 0 ("not bothered at all"), 1 ("bothered a little"), or 2 ("bothered a lot").16 Consistent with previous studies, a cut-off of PHQ-15 score ≥ 15 was defined as experiencing severe physical symptom burden (termed as severe symptoms) in our study, as this score indicates severe symptomology.^{16,17} We used multiple imputation to estimate the individual physical symptom responses for participants who had missing values in the 15 items (missingness up to 25%, or 4 responses, per individual). Multiple imputation was performed using the R package MICE in C-19 Resilience and DBDS, using predictive mean matching method.¹⁸ In Omtanke2020, multiple imputation was performed in SAS using proc mi using the fully conditional specification (FCS) regression method.¹⁹ Those

with more than 25% missingness in the PHQ-15 were excluded from the analysis. Because data on physical symptoms was collected prospectively, we used assessments since enrolment for the non-COVID group, and since diagnosis for the COVID group.

Several covariates were included in the analysis, when available (Supplementary Table S1). The included covariates were age (discrete numeric in years), gender (male, female, or other), average monthly income (low, lowmedium, medium, medium-high, or high income; not available in Omtanke2020), residency (capital or elsewhere), relationship status (single or in a relationship; not available in DBDS), body mass index (BMI, categorized as <25 kg/m² [normal or underweight], 25–30 kg/m² [overweight], or >30 kg/m² [obese]), current smoking (no or yes), habitual drinking (no or yes), history of psychiatric disorder (no or yes), pre-existing somatic comorbidity (no, one or more comorbidities), and response period (June 2020 or earlier, July-September 2020, October-December 2020, January–March 2021, April–June 2021, July– September 2021, October-December 2021, or January 2022 or after). We also included variables of current mental health status measured at the same survey (no or yes) for potential depression (Patient Health Questionnaire (PHQ-9)), anxiety (General Anxiety Disorder (GAD-7)) and COVID-19-related distress symptoms (Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) and the PTSD checklist for DSM-5; not available in DBDS), as described in our previous study.14 Covariates with missing values were grouped as a separate level.

Statistical analysis

We first described the distribution of the above covariates between the COVID group and non-COVID group, as well as by acute illness severity and time since diagnosis for the COVID-19 group. We conducted a cross-sectional analysis comparing the prevalence of severe symptoms (PHQ-15 \geq 15) in the COVID group, overall and by illness severity (bedridden and hospitalization) and time since diagnosis, to that of the non-COVID group. We applied a robust (modified) Poisson regression model to estimate prevalence ratios (PRs) with 95% confidence intervals (CIs), with a quasi-likelihood model used to fit a binary outcome.²⁰ A sandwich estimator with exchangeable working correlation structure was applied in the model to control for intra-individual correlation when repeated measures were available.²¹ The PRs were calculated in crude models and then in adjusted models controlling for age, gender, average monthly income, residency, relationship status, BMI, current smoking, habitual drinking, previous diagnosis of psychiatric disorder, pre-existing somatic comorbidity, and response period. Covariates not measured in an individual cohort were not adjusted for in the analysis of that cohort. All analyses were performed among individuals with complete information on variables. We also stratified by gender, age, mental health indicators, and pre-existing somatic comorbidity to investigate if these factors would modify the association between COVID-19 and severe symptoms. To evaluate the influence of vaccination on physical symptoms, we further calculated the PR in C-19 Resilience and Omtanke2020 cohorts by restricting the analysis to those ever reported being partly or fully vaccinated. To investigate of the associations for individual symptoms, we estimated PRs for the 15 measured symptoms individually, analysing separately reporting being "bothered a little" or being "bothered a lot". The Bonferroni correction method was used to correct the P values for multiple testing. The analysis of PRs for reporting "bothered a lot" was further performed by illness severity and by time since diagnosis.

In the Swedish Omtanke2020 Study, a subset of individuals with a COVID-19 diagnosis had repeated measures of physical symptoms: one *prior to* and one following their COVID-19 diagnosis (N = 398). We conducted a pairwise analysis assessing the prevalence of individual symptoms comparing post-COVID (first response after diagnosis) to pre-COVID (last response before diagnosis) measures, i.e., pre-/post-COVID comparison. The pre-COVID measure was collected before infection, and was used as the reference. The extension of the modified Poisson regression models mentioned above was performed to assess the difference in prevalence of individual symptoms between the two time-points.

We performed the above analyses using a standardized analysis protocol in all four cohorts, and finally, to combine aggregated data from the cohorts, we metaanalysed the output from each cohort with a randomeffects model using the metafor package in R to estimate an overall result for all analyses.²² Heterogeneity of the findings was examined using the I^2 statistic.²³ Data management was done in SAS (v9.4) in Omtanke2020. Statistical analyses were conducted in R (version 4.0.5). This study is reported according to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. QS and UAV had full access to the Icelandic data, EEJ and FF had full access to the Swedish data, OVE and SUJ had full access to the Norwegian data, MD and OBVP had full access to the Danish data, and take responsibility for the integrity and the accuracy of the data in the respective cohort. The corresponding authors had final responsibility for the decision to submit for publication, upon the approval from all authors.

Results

Baseline characteristics

Of the 64,880 participants, 22,382 (34.5%) reported having been diagnosed with COVID-19. Persons with

COVID-19 were younger, had a lower BMI, and had a lower proportion of pre-existing psychiatric disorder and somatic comorbidity, compared with the non-COVID group (Table 1). The demographics varied across the cohorts, with participants of MAP-19 being younger in age and more likely to be single than participants of other cohorts (Supplementary Table S2). Among persons with COVID-19, 28.0% were bedridden during acute infection (18.4% for 1–6 days; and 9.6% for 7 days or more) and 1.0% were hospitalized (Table 1).

Physical symptom burden

The distribution of PHQ-15 scores for COVID and non-COVID group were presented in Supplementary Figure S2. After dichotomizing the score, the prevalence of severe symptoms was higher among the COVID-19 group than the non-COVID group in all cohorts (Supplementary Table S3): 16.0% vs. 9.7% in C-19 Resilience, 8.0% vs. 5.5% in Omtanke2020, 8.5% vs. 7.6% in MAP-19, and 1.6% vs. 1.2% in DBDS, with MAP-19 and DBDS having larger proportion of participants infected with probable omicron variant (Supplementary Figure S3). Compared with the non-COVID group, individuals diagnosed with COVID-19 had an overall higher prevalence of severe symptoms during the entire study period, in each cohort as well as combined (overall adjusted PR 1.37 [95% CI 1.23-1.52], I^2 43.2%; P < 0.001) (Fig. 1). The prevalence increase was noted regardless of gender, age groups, existence of depressive, anxiety or COVID-19 related distress symptoms, or pre-existing somatic comorbidity (Supplementary Figure S4). As the majority of the participants reported being partly or fully vaccinated, we found similar increase in prevalence when restricting the analytic sample to vaccinated individuals (Supplementary Tables S4 and S5). Higher prevalence increase was observed for among individuals without depressive or anxiety symptoms (Supplementary Figure S4).

Longer time bedridden during acute infection was associated with a higher prevalence of severe symptoms in a dose-response manner, and the highest prevalence was consistently observed up to 27 months after diagnosis among participants bedridden for 7 days or more (combined results in Fig. 2 and by cohort in Supplementary Figure S5A). A higher prevalence was also observed among individuals hospitalized for COVID-19 from 2 months to 22 months following diagnosis (Supplementary Figure S5B).

When investigating individual symptoms, we found the most prevalent symptoms to be headaches, low energy/fatigue, joint pain, trouble sleeping, and back pain (Supplementary Table S6). Compared with the non-COVID group, we found that a COVID-19 diagnosis was associated with a higher prevalence of several symptoms (Fig. 3A), including being bothered a lot due to shortness of breath (PR 2.15 [1.37–3.38]), dizziness

(PR 1.58 [1.41-1.76]), heart racing (PR 1.55 [1.27-1.89]), headaches (PR 1.38 [1.23-1.54]), and back pain (PR 1.10 [1.05–1.17]) as well as being bothered a little due to chest pain (PR 1.34 [1.15-1.56]), low energy/fatigue (PR 1.08 [1.04-1.13]), and trouble sleeping (PR 1.04 [1.02-1.06]). Elevations in the prevalence of similar symptoms were noted in individual cohorts except for DBDS, where less symptoms were identified (Supplementary Figure S6). We observed a consistently higher prevalence, particularly for individuals bedridden 7 days or longer or hospitalized for COVID-19, among 8 of the 15 measured symptoms (Fig. 4, Supplementary Table S7 and Supplementary Figure S7). There was no clear decline in the prevalence increase over time for most symptoms, except for dizziness where the prevalence increase declined over time.

Longitudinal analysis

The pairwise analysis of the subset of Omtanke2020 adult participants with pre- and post-COVID-19 measures of physical symptoms (n = 398, mean time interval = 3.2 months) largely confirmed the results of our cross-sectional analysis. As compared to before diagnosis, we observed an elevation of being bothered a lot due to headaches (PR 2.03 [1.64–2.54]) and low energy/fatigue (PR 1.36 [1.22–1.53]) after diagnosis of COVID-19 as well as being bothered a little due to shortness of breath (PR 1.45 [1.15–1.82]), chest pain (PR 1.76 [1.36–2.27]) and dizziness (PR 1.46 [1.22–1.74]) after diagnosis of COVID-19 (Fig. 3B).

Discussion

In this multinational observational study, we found an association between COVID-19 and persistence of severe physical symptoms during the follow-up from diagnosis to up to 27 months thereafter. Overall, persons diagnosed with COVID-19 had a 37% higher prevalence of severe symptoms compared with those not diagnosed. The association was strongly modified by acute COVID-19 illness severity, as the prevalence increase was particularly great among individuals who were bedridden 7 days or more. The higher prevalence was observed for multiple symptoms, in particular shortness of breath, chest pain, dizziness, headaches, and low energy/fatigue. This finding was similarly identified in a longitudinal analysis comparing severe symptoms before and after diagnosis in Sweden. The persistently increased prevalence of multiple symptoms more than two years following severe COVID-19 demonstrates the importance of a sustained monitoring of targeted physical symptoms in this patient group.

Long-term sequela following COVID-19 have been discussed continuously since the beginning of the pandemic. However, inconsistent definitions of post-COVID condition and a lack of comparison to individuals without COVID-19 diagnosis have made it

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Make13,290 (13,3%)8577 (80,0%)Female13,290 (13,3%)8558 (61,9%)Other80 (0,2%)13 (0,1%)Mising14 (0,1%)61 (-0,1%)Mising14 (0,1%)61 (-0,1%)Mary plans (SD)54 (14,7)49 (11,77)18-29 yaas334 (7.8%)3517 (11,7%)30-39 yaars517 (12,0%)510 (14,6%)40-49 yaars6775 (15,9%)4505 (12,0%)50-59 yaas0390 (24,3%)4005 (17,9%)70 yaars or older6968 (16,4%)1767 (7.9%)Masing0396 (14,4%)4005 (17,9%)Masing6968 (16,4%)2786 (12,4%)Low income6969 (12,0%)4463 (10,9%)Medium income6961 (14,4%)3815 (17,0%)Medium income6961 (14,4%)3815 (17,0%)Medium income6961 (14,4%)3815 (17,0%)Medium income6961 (14,4%)3848 (12,2%)Missing1989 (2,8%)1848 (12,2%)Missing1989 (2,8%)150 (2,3%)Normaszurd ¹ 12,544 (50,7%)153 (2,1%)Missing ortholog219 (5,5%)153 (14,5%)Bigle725 (18,6%)153 (14,5%)Missing ortholog219 (5,5%)153 (14,5%)Normaszurd ¹ 12,524 (50,7%)153 (12,5%)Missing ortholog219 (5,5%)153 (12,5%)Missing ortholog219 (5,5%)153 (12,5%)Normaszurd ¹ 12,524 (50,5%)153 (12,5%)Sign Ortholog219 (5,5%)153 (12,5%)Normaszurd ¹ <td< td=""><td>Gender</td><td></td><td></td></td<>	Gender		
Fende29,14 (68,5%)13,85 (619%)Other30 (0.2%)31 (0.1%)Missing14 (40,1%)6 (40.1%)Age41 (40,1%)6 (40.1%)Ages3147 (73%)30 (117%)30-39 years31347 (73%)30771 (16.8%)40-49 years5076 (15.9%)46.96 (10.%)50-59 years0970 (25.5%)5050 (46.%)60-69 years10.309 (24.3%)0006 (17.5%)60-69 years10.309 (24.3%)0006 (17.5%)Average morthly income596 (16.4%)27.66 (12.4%)Low medium income596 (10.5%)3815 (17.0%)Medium income596 (12.5%)3815 (17.0%)Medium-high income596 (12.5%)3815 (17.5%)Medium-high income596 (12.5%)3826 (12.3%)Missing12.96 (55.5%)316 (2.3%)Missing or abrad21.95 (12.6%)315 (12.6%)Single or abrad21.56 (51.5%)4380 (12.5%)Missing or abrad21.55 (15.6%)15.30 (13.%)Not measured*21.55 (12.5%)593 (13.%)Single or abrad21.56 (51.5%)393 (13.%)Not measured*21.55 (12.5%)305 (15.9%)Single or abrad21.55 (12.5%)305 (15.9%)Missing or abrad21.55 (12.5%)305 (15.9%)Si	Male	13,290 (31.3%)	8507 (38.0%)
Other80 (02)13 (01%)6 (00.1%)Missing14 (0.0.%)6 (0.0.%)AgeJa-29 years334 (7.8')457 (1.7', N.30-39 years517 (12.0%)3771 (16.8%)40-49 years675 (0.5 %)4596 (1.0%)50-59 years979 (2.3 %)505 (2.4 %)50-59 years10.309 (24.3'%)4005 (7.7 %)70 years or older979 (2.3 %)2005 (7.7 %)Missing14 (0.1%)776 (7.9 %)Average monthly income5499 (12.9 %)2786 (12.4 %)Low income5499 (12.9 %)3815 (17.0 %)Medium income626 (14.7 %)3815 (17.0 %)Medium income626 (14.7 %)3815 (17.0 %)Medium income626 (12.9 %)3848 (17.2 %)Missing1198 (2.8 %)3848 (17.2 %)Missing1198 (2.8 %)3434 (15.0 %)Missing or abroad20.755 (8.8 %)3438 (15.0 %)Not measured"14.841 (60.7 %)3439 (15.0 %)Missing or abroad20.755 (8.8 %)15.953 (7.1 %)In a relationship21.650 (12.0 %)4380 (12.9 %)Missing or abroad20.950 (14.4 %)15.953 (7.1 %)In a relationship21.660 (12.0 %)4380 (13.9 %)Missing or abroad20.950 (14.4 %)15.953 (7.1 %)In a relationship21.660 (12.0 %)15.953 (7.1 %)Missing or abroad20.950 (13.6 %)39.65 (25.9 %)Joshee23.970 (14.5 %)20.95 (9.5 %)Joshee23.970 (14.5 %)20.970 (15.8 %)Joshe	Female	29,114 (68.5%)	13,856 (61.9%)
Missing14 (-0.1%)6 (-0.1%)ApeApeMan, years (5D)54 (14.7)49 (11.7)18-29 years334 (72%)257 (11.7%)30-39 years67/6 (15.9%)4696 (21.0%)30-39 years0.77/6 (15.9%)4696 (21.0%)50-59 years0.902 (23.5%)4696 (21.0%)60-69 years0.10.309 (24.3%)4005 (17.9%)Mising10.309 (24.3%)4005 (17.9%)Mising0.10.309 (24.3%)0.005 (17.9%)Mising6968 (16.4%)776 (7.9%)Meangementhy income5499 (12.9%)2786 (12.4%)Low income6962 (15.0%)3815 (17.0%)Medium income6962 (15.0%)3848 (12.2%)Medium income6962 (15.0%)3848 (12.2%)Missing11.98 (28.%)3349 (15.0%)Missing10.98 (24.8%)3349 (15.0%)Missing10.98 (28.%)15.63 (2.3%)Missing are abrick12.544 (50.7%)975 (43.6%)Missing are abrick12.544 (50.7%)975 (43.6%)Missing are abrick12.544 (50.7%)975 (13.6%)Missing are abrick12.542 (50.7%)12.589 (56.2%)Missing are abrick12.562 (28.5%)13.93 (13.6%)No measured?12.660 (51.0%)43.80 (14.6%)No measured?12.660 (51.0%)43.80 (13.6%)Missing are abrick12.660 (51.0%)43.80 (13.6%)No measured?12.660 (51.0%)43.80 (13.6%)No measured?12.660 (51.0%)43.80 (13.6%)No measured?<	Other	80 (0.2%)	13 (0.1%)
AppMean, gers (D)5 (4 (4.7)4 (9 (1.7)18-39 yars334 (7.8%)257 (11.7%)30-39 yars334 (7.8%)257 (11.7%)30-40 yars6776 (15.9%)406 (21.6%)60-69 yars0.909 (23.5%)4005 (7.7%)60-69 yars6968 (16.4%)4005 (7.7%)70 yars or older6968 (16.4%)4005 (7.7%)70 yars or older6968 (16.4%)767 (19.9%)Masing14 (-0.1%)767 (9.9%)Medium income549 (12.9%)2786 (12.4%)Medium income6361 (14.7%)3815 (7.0%)Medium income6361 (14.7%)3815 (7.0%)Medium income6362 (16.4%)3615 (7.8%)Medium income731 (11.1%)365 (15.1%)Missing109 (28.5%)348 (17.2%)Missing109 (28.5%)348 (17.2%)Missing or abroad20 (50.5%)348 (17.2%)Missing or abroad20 (50.5%)349 (15.5%)Missing or abroad20 (50.5%)316 (23.5%)Missing or abroad20 (50.5%)316 (23.5%)Missing or abroad20 (50.5%)393 (17.6%)Missing or abroad20 (50.5%)393 (15.7%)Missing10.6% (15.1%)393 (17.6%)Missing10.6% (15.1%)393 (17.6%)Missing10.6% (15.1%)393 (15.7%)Missing10.6% (15.1%)393 (15.7%)Missing10.9% (15.1%)393 (17.6%)Missing10.9% (15.1%)393 (15.7%)Missing10.9% (15.1%)393 (15.1%)<	Missing	14 (<0.1%)	6 (<0.1%)
Man, yan; (b) 54 (47) 49 (17) 18-29 yaas 3334 (73%) 267 (11%) 30-39 yaas 5117 (120%) 3771 (16.8%) 40-49 yaars 576 (15 9%) 4696 (7.0%) 50-59 yaars 0.030 (24.3%) 4005 (17.9%) 50-69 yaars 0.030 (24.3%) 4005 (17.9%) 70 yaars or older 506 (6 4%) 7 (40.3%) 70 yaars or older 569 (16.4%) 7 (40.3%) Missing 14 (-0.1%) 7 (40.3%) Average morthly income 562 (15.0%) 4463 (19.9%) Medium income 562 (15.0%) 4463 (19.9%) Medium-high income 362 (15.0%) 3844 (17.2%) Missing 1198 (2.8%) 310 (50.6%) Not measured? 199 (2.8%) 310 (50.6%) Missing or aborad 219 (6.5%) 3848 (17.2%) Missing or aborad 219 (3.0%) 310 (3.6%) Missing or aborad 219 (0.5%) 310 (0.6%) Missing or aborad 21.667 (2.8%) 303 (13.6%) Missing or aborad 21.667 (2.8%) 303 (13.6%)	Age		
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30-39 years 517 (12.0%) 377 (12.5%) 40-49 years 676 (15.9%) 4696 (21.0%) 50-59 years 3030 (24.3%) 4005 (12.9%) 60-69 years 0309 (24.3%) 4005 (12.9%) 70 years or older 6968 (16.4%) 7 (-0.1%) Average monthly income 14 (-0.1%) 7 (-0.1%) Average monthly income 525 (12.0%) 4463 (19.9%) Medium income 626 (12.4%) 3815 (17.0%) Medium income 626 (12.0%) 4463 (19.9%) Medium income 626 (12.0%) 4463 (19.9%) Mising 118 (2.8%) 394 (12.5%) Mising on abrade 436 (0.5%) 3848 (17.2%) Missing on abrade 20,755 (48.4%) 394 (50.5%) Besolverce 20,755 (48.4%) 395 (53.4%) Missing on abrade 12,660 (51.0%) 4380 (19.6%) Missing on abrade 12,667 (23.8%) 16,350 (73.9%) Missing on abrade 12,660 (51.0%) 4380 (19.6%) Missing on abrade 12,660 (51.0%) 3630 (0.5%) Missing on abrade	18–29 years	3334 (7.8%)	2617 (11.7%)
4-4-9 years 676 (15 9%) 4596 (21.0%) 50-59 years 9799 (23.5%) 505 (24.6%) 60-69 years 10.909 (24.3%) 4005 (17.9%) 70 years or older 6968 (16.4%) 776 (7.9%) Missing 14 (0.1%) 776 (7.9%) Missing 14 (0.1%) 776 (15.9%) Average monthly income 5499 (12.9%) 2786 (12.4%) Low income 549 (12.9%) 281 (12.9%) Medium income 652 (15.0%) 4463 (19.9%) Medium-high income 6362 (15.0%) 4463 (19.9%) Medium-high income 4731 (11.1%) 3605 (16.1%) Missing 1198 (28.9%) 348 (17.2%) Missing or abroad 1288 (19.4%) 349 (15.0%) Residence* 20725 (48.8%) 3259 (56.2%) Missing or abroad 129 (19.5%) 4380 (19.5%) Bissing or abroad 129 (50.5%) 309 (15.5%) Missing or abroad 1260 (51.0%) 1393 (71.%) In a relationship 3140 (65.%) 309 (15.5%) Not masured* 1267 (29.8%)	30-39 years	5117 (12.0%)	3771 (16.8%)
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60-69 yeas 40309 (24,3%) 4005 (7.9%) 70 yeas or older 6068 (16.4%) 77 (6.7%) Missing 14 (403) 7 (6.0%) Average monthly income 549 (12.4%) 3815 (17.0%) Medium income 6261 (14.7%) 3815 (17.0%) Medium income 6261 (14.7%) 305 (16.1%) Medium-high income 360 (8.5%) 3848 (17.2%) Medium-high income 3606 (8.5%) 3848 (17.2%) Missing 1198 (2.8%) 315 (2.3%) Not measured ¹ 4.441 (42.9%) 349 (15.0%) Not measured ¹ 4.244 (9.0%) 315 (2.3%) Missing or abroad 20.90 (5%) 400 (2%) Ekselence ¹ 20.90 (5%) 400 (2%) Missing or abroad 20.90 (5%) 400 (2%) Not measured ¹ 2.450 (5.0%) 305 (13.%) In a relationship 241 (6.5%) 305 (13.%) Not measured ¹ 2.470 (29.8%) 305 (13.%) 2.50 overweight 40 (405.1%) 305 (13.%) 2.50 overweight 14.904 (35.1%) <td< td=""><td>50–59 years</td><td>9979 (23.5%)</td><td>5510 (24.6%)</td></td<>	50–59 years	9979 (23.5%)	5510 (24.6%)
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Missing 14 (<0.1%) 7 (<0.1%) Average monthly income 5499 (12.9%) 2786 (12.4%) Low income 6261 (14.7%) 3815 (17.0%) Medium income 6362 (15.0%) 4463 (19.9%) Medium-high income 6366 (8.5%) 3848 (17.2%) Medium-high income 3606 (8.5%) 3484 (17.2%) Missing 1198 (2.8%) 3249 (15.0%) Not measured ¹⁰ 21660 (8.5%) 3484 (17.2%) Missing or abroad 219.2% (50.7%) 3752 (43.6%) Besidence ⁴⁰ 20,735 (48.8%) 22,589 (56.2%) Missing or abroad 219.05%) 4380 (19.6%) Besidence ⁴⁰ 21,560 (51.0%) 4380 (19.6%) Missing or abroad 219.05%) 4380 (19.6%) In a relationship 21.660 (51.0%) 4380 (19.6%) Not measured ¹⁰ 21.660 (51.0%) 4380 (19.6%) Single 102 (52.8%) 303 (53.0%) 25-30 orania or low weight 1,591 (41.4%) 0.0090 (45.1%) 25-30 orania or low weight 1,591 (43.5%) 303 (53.0%) 2	70 years or older	6968 (16.4%)	1776 (7.9%)
kerage monthly income 5499 (2.9%) 2786 (12.4%) Low-medium income 5469 (12.7%) 3815 (17.0%) Medium-high income 6362 (15.0%) 4463 (19.9%) Medium-high income 3626 (15.0%) 4463 (19.9%) High income 3606 (65.%) 3688 (17.2%) Missing 1989 (2.8%) 3649 (17.2%) Not measured ¹ 1.4841 (34.9%) 3849 (15.0%) Restance ¹ 21.544 (50.7%) 3757 (43.6%) Kasing or abroad 21.544 (50.7%) 9757 (43.6%) Beswhere 20.548 (50.7%) 12.589 (50.2%) Issing or abroad 21.90 (5%) 410.02%) Missing or abroad 21.90 (5%) 410.02%) Is a relationship 21.660 (51.0%) 4380 (19.6%) Not measured ¹ 24.00 (52.0%) 3200 (19.6%) Not measured ¹ 24.00 (52.0%) 3200 (19.6%) Single 24.00 (52.0%) 3200 (19.6%) Not measured ¹ 1.591 (41.4%) 0.0090 (45.1%) 2-30 oneweight 1.60 (20.5%) 390 (16.%) 2-30 oneweight	Missing	14 (<0.1%)	7 (<0.1%)
Low income 5499 (12,9%) 2786 (12,4%) Low medium income 6261 (14,7%) 3815 (17.0%) Medium income 6362 (15,0%) 3461 (19,9%) Medium-ingh income 3606 (8,5%) 3648 (17.2%) Missing 1198 (2.8%) 3616 (2.3%) Missing 1198 (2.8%) 3348 (17.2%) Not measured ¹ 1484 (34.9%) 3349 (15.0%) Residence ¹ 20.735 (48.6%) 12,589 (56.2%) Missing or abroad 210,05% 410 (0.5%) Missing or abroad 210,05% 410 (0.5%) Missing or abroad 210,05% 410 (0.5%) Single 7925 (18.6%) 1593 (7.1%) In a relationship 21,660 (51.0%) 4380 (19.0%) Missing 21,660 (51.0%) 4380 (19.0%) Not measured ¹ 2.670 (29.8%) 1593 (7.1%) In a relationship 21,660 (51.0%) 4380 (19.0%) Missing 21,660 (51.0%) 3930 (35.0%) So (or genesity) 21,660 (51.0%) 3930 (35.0%) So (or genesity) 21,660 (51.0%)	Average monthly income		
Low-medium income 6261 (14.7%) 3815 (17.0%) Medium-income 6362 (15.0%) 4463 (19.9%) Medium-income 6366 (8.5%) 3848 (17.2%) Mising 11.98 (2.8%) 516 (2.3%) Not measured ¹³ 14.84 (3.9%) 3349 (15.0%) Not measured ¹³ 24.84 (30.7%) 9752 (43.6%) Escience 20.725 (48.8%) 21.589 (56.2%) Missing or abroad 20.59% (48.8%) 21.589 (56.2%) Missing or abroad 20.59% (48.8%) 1593 (71.%) In a relationship status 590 (3.8%) 1593 (71.%) Single 7925 (18.6%) 1593 (71.%) In a relationship 21.660 (51.0%) 4380 (19.6%) Not measured ¹ 21.662 (23.8%) 16.350 (73.0%) Bild (sfm ²) 12.672 (23.8%) 16.350 (73.0%) Sing 0.40 (40.5%) 303 (35.9%) 3-30 obes 8708 (20.5%) 3035 (35.9%) 3-30 obes 8708 (20.5%) 3035 (35.9%) 3-30 obes 70.848 (86.7%) 0.0279 (90.6%) No 5.458 (83.4%	Low income	5499 (12.9%)	2786 (12.4%)
Medium ingome 6362 (15 0%) 4463 (19 9%) Medium-high income 4731 (11.%) 3605 (61.%) High income 3606 (8 5%) 3844 (17.2%) Missing 1198 (2.8%) 3164 (17.2%) Not measured" 14.841 (34.9%) 3349 (15.0%) Residence" Capital area 21.544 (50.7%) 9752 (43.6%) Bisowhere 20.735 (48.8%) 12.589 (56.2%) Missing or abroad 20.735 (48.8%) 12.589 (56.2%) Missing or abroad 21.90 (5%) 4380 (19.6%) In a relationship 1593 (71%) 1593 (71%) In a relationship 21.660 (51.0%) 4380 (19.6%) Missing 21.606 (51.0%) 4380 (19.6%) Missing 14.06%) 590 (0.3%) Not measured" 12.672 (29.8%) 16.350 (73.0%) Missing 10.909 (45.1%) 20.909 (45.1%) 25-30 overweight 14.904 (35.1%) 8035 (35.9%) 35.30 obes 36.848 (86.7%) 20.279 (90.6%) Missing 20.209 (90.6%) 23.64 (12.	Low-medium income	6261 (14.7%)	3815 (17.0%)
Medium-high income 4731 (11%) 9605 (16.1%) High income 3606 (8.5%) 3848 (12.7%) Missing 1198 (2.8%) 516 (2.3%) Not measured" 1198 (2.8%) 516 (2.3%) Residence* 752 (43.6%) 752 (43.6%) Residence* 752 (43.6%) 752 (43.6%) Missing or abroad 20,755 (48.8%) 752 (43.6%) Missing or abroad 20,755 (48.8%) 752 (43.6%) Relationship status 752 (43.6%) 752 (43.6%) Single 90,5%) 91593 (71%) In a relationship 21,660 (51.0%) 4380 (19.6%) Not measured" 21,660 (51.0%) 4380 (19.6%) Not measured" 21,627 (29.8%) 59 (0.3%) Joso obse 0.6350 (73.0%) 6350 (73.0%) So obse 30 obse 30 obse 30 obse Joso obse 30 obse 30 (28.5%) 30 (28.5%) Missing 30.279 (90.6%) 30 (28.9%) Yes 30.268 (85.7%) 30.279 (90.6%) Yes 30.268 (85.7%)	Medium income	6362 (15.0%)	4463 (19.9%)
High income 3606 (& 5%) 3484 (17.2%) Mising 1198 (2.8%) 516 (2.3%) Not measured ¹¹ 148,41 (34.9%) 3349 (15.0%) Residence 2 349 (15.0%) Residence 2 349 (15.0%) Issing or abroad 21,544 (50.7%) 9752 (43.6%) Besidence 20735 (48.8%) 12,589 (56.2%) Missing or abroad 20735 (48.8%) 12,589 (56.2%) Missing or abroad 20735 (48.8%) 102,8%) Relationship status 1593 (71.%) 102,8%) Single 7925 (18.6%) 1593 (71.%) Missing 12,660 (51.0%) 4380 (19.6%) Missing 12,662 (29.8%) 1593 (71.%) Not measured ¹¹ 21,660 (51.0%) 1363 (73.0%) Missing 12,672 (29.8%) 16350 (73.0%) Solowendight 12,672 (29.8%) 16350 (73.0%) Solowendight 14,904 (55.1%) 309 (16.5%) 30 obse 309 (16.5%) 399 (18.%) Missing 2195 (30.%) 399 (13.%)	Medium-high income	4731 (11.1%)	3605 (16.1%)
Missing 1198 (2.8%) Stife (2.3%) Mot measured ¹⁰ 1248 (13.4.9%) 3349 (15.0%) Residence ¹⁰ 15.44 (50.7%) 752 (43.6%) Repaired 20,735 (48.8%) 12,589 (56.2%) Missing or abroad 219 (0.5%) 41 (0.2%) Relationship status 7925 (18.6%) 1593 (71.%) In a relationship 14,660 (51.0%) 4380 (19.6%) Missing 241 (0.6%) 4380 (19.6%) Not measured ¹⁰ 2,672 (29.8%) 16,350 (73.0%) Not measured ¹⁰ 2,672 (29.8%) 16,350 (73.0%) Missing 241 (0.6%) 3638 (13.2%) So overweight 1,591 (1.4%) 0,090 (45.1%) Not measured ¹⁰ 1,591 (1.4%) 3035 (35.9%) -30 obes 570 overweight 1,991 (4.9%) 3035 (35.9%) -30 obes 570 (30.8%) 399 (18.%) 302.7%) -30 obes 570 (30.8%) 399 (18.%) 302.7%) -30 obes 526 (12.3%) 303 (9.0%) 303 (9.0%) Vers 30.6848 (86.7%) 303 (9.0%)	High income	3606 (8.5%)	3848 (17.2%)
Not measured* 14.841 (34.9%) 3349 (15.0%) Residence* Reprint of partial area 21,544 (50.7%) 752 (43.6%) Issen of aread 20,735 (48.8%) 22,589 (56.2%) Missing or abroad 20 (0.5%) 41 (0.2%) Relationship status In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 21,660 (51.0%) 4380 (19.6%) Not measured* 12,672 (29.8%) 10,090 (45.1%) Stormal or low weight 1,059 (14.4%) 0,090 (45.1%) 25-30 overweight 14,904 (35.1%) 00,900 (45.1%) Stormal or low weight 75.91 (41.4%) 0,090 (45.1%) Missing 20,30% 385 (17.2%) 30 obes 8708 (20.5%) 385 (17.2%) Missing 0,0279 (90.6%) 390 (90.4%) Ves 5236 (12.3%) 02.799 (90.6%) Mosing 64.848 (86.7%) 02.799 (90.6%) Ves 0,345 (85.83.4%) 390 (90.4%) Ves 0,345 (85.83.4%) 30.279 (90.6%)	Missing	1198 (2.8%)	516 (2.3%)
Residence ^b Capital area 21,544 (50.7%) 9752 (43.6%) Edwhere 20,755 (48.8%) 12,589 (56.2%) Missing or abroad 219 (05.%) 14.02%) Relationship status 593 (71.%) Relationship 21,660 (51.0%) 4380 (19.6%) Missing 241 (0.6%) 4380 (19.6%) More meaverd ^a 21,660 (51.0%) 29 (0.3%) Nor meaverd ^a 21,670 (29.8%) 29 (0.3%) Zoromal or low weight 1,591 (41.4%) 0090 (45.1%) 25-30 overweight 4,904 (35.1%) 8035 (35.9%) No 30,88 (17.2%) 399 (1.8%) Missing 20,279 (90.6%) 20,279 (90.6%) Yes 52,64 (8.67%) 20,279 (90.6%) Yes 30,48 (8.67%) 20,279 (90.6%) Yes 54,55 (8.4,86 (8.7%) 20,279 (90.6%) Yes 30,48 (8.67%) 30,210.6%) <td>Not measured^a</td> <td>14,841 (34.9%)</td> <td>3349 (15.0%)</td>	Not measured ^a	14,841 (34.9%)	3349 (15.0%)
Capital area 21,544 (50.%) 9752 (43.6%) Elsewhere 20,735 (48.8%) 12,589 (56.2%) Missing or abroad 219 (05.%) 41 (0.2%) Relationship status 593 (71.%) 593 (71.%) In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 21,660 (51.0%) 4380 (19.6%) Not measured* 21,672 (29.8%) 16,350 (73.0%) BWI (kg/m²) 4 25< normal or low weight	Residence ^b		
Ekewhere 20,735 (48.8%) 12,589 (56.2%) Missing or abroad 219 (0.5%) 41 (0.2%) Relationship status 500 (51.0%) 1593 (7.1%) In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 241 (0.6%) 4380 (19.6%) Not measured* 26,72 (29.8%) 16,350 (73.0%) BMI (kg/m*) 59 (0.3%) 16,350 (73.0%) e25 normal or low weight 17,591 (41.4%) 10.090 (45.1%) 2-30 overweight 44.904 (35.1%) 8035 (35.9%) 3-30 obese 708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 399 (1.8%) Verser 523 (12.3%) 2031 (9.0%) Missing 202,79 (90.6%) 10.090 (4.5%) Yes 523 (12.3%) 2013 (9.0%) Missing 2013 (9.0%) 2013 (9.0%) Missing 414 (1.0%) 20.279 (90.6%) Yes 7043 (16.6%) 20.379 (17.0%) Missing 414 (1.0%) 20.379 (17.0%) Yes 7043 (16.6%) 37.96 (17.0%)	Capital area	21,544 (50.7%)	9752 (43.6%)
Missing or abroad 219 (0.5%) 41 (0.2%) Relationship status	Elsewhere	20,735 (48.8%)	12,589 (56.2%)
Relationship status Single 7925 (18.6%) 1593 (7.1%) In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 2140 (0.6%) 59 (0.3%) Not measured ¹⁰ 2672 (29.8%) 6350 (73.0%) To measured ¹⁰ 10.690 (45.1%) 6350 (73.0%) Sommal or low weight 17.591 (41.4%) 10.090 (45.1%) 25-30 overweight 14.904 (35.1%) 8035 (35.9%) >30 obese 8708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 399 (1.8%) Verrent smoking status 2536 (12.3%) 399 (1.8%) Ves 2536 (12.3%) 2013 (9.0%) Missing 526 (12.3%) 2013 (9.0%) Missing 526 (12.3%) 2013 (9.0%) Mo 36,848 (86.7%) 20.797 (9.0.6%) Missing 203 (16.6%) 20.797 (9.0.6%) Mo 36,848 (86.7%) 20.797 (9.0.6%) Mo 36,455 (83.4%) 36.784 (83.0%) Mo 30,46 (63.0%) 37.98 (17.0%) Habitary of psychiatric disorder	Missing or abroad	219 (0.5%)	41 (0.2%)
Single 7925 (18.6%) 1593 (7.1%) In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 244 (0.6%) 59 (0.3%) Not measured ¹ 12,672 (29.8%) 16,350 (73.0%) BMIK (kg/m ²) 15,350 (73.0%) 16,350 (73.0%) s25 normal or low weight 17,591 (41.4%) 10,090 (45.1%) 25-30 overweight 14,904 (35.1%) 8035 (35.9%) >30 obese 8036 (20.5%) 3858 (17.2%) Missing 16,848 (86.7%) 3858 (17.2%) Missing 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 20,139 (9.0%) Missing 414 (1.0%) 90 (0.4%) Missing 414 (1.0%) 90 (0.4%) Missing 18,545 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.0%) Mo 31,186 (73.4%) 18,472 (82.5%) Yes 11,186 (73.4%) 18,472 (82.5%) Yes 10,705 (52.5%) 3790 (16.9%)	Relationship status		
In a relationship 21,660 (51.0%) 4380 (19.6%) Missing 241 (0.6%) 59 (0.3%) Not measured ¹¹ 12,672 (29.8%) 16,350 (73.0%) BMI (kg/m ²) 12,572 (29.8%) 16,350 (73.0%) BMI (kg/m ²) 17,591 (41.4%) 10,090 (45.1%) 25-30 overweight 14,904 (35.1%) 8035 (35.9%) >30 obese 8708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 3858 (17.2%) Missing 202,959 (3.0%) 390 (0.4%) Verrent smoking status 20,279 (90.6%) Yes 5236 (12.3%) 20,279 (90.6%) Missing 414 (1.0%) 90 (0.4%) Missing 5236 (12.3%) 2013 (9.0%) Yes 7043 (16.6%) 3798 (17.0%) Missing 414 (1.0%) 90 (0.4%) Mo 35,455 (83.4%) 3798 (17.0%) Habitual drinking 10,705 (25.2%) 3790 (16.9%) Yes 10,705 (25.2%) 3790 (16.9%) No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607	Single	7925 (18.6%)	1593 (7.1%)
Missing 241 (0.6%) 59 (0.3%) Not measured ^a 12,672 (29.8%) 16,350 (73.0%) BMI (kg/m ²) - - <25 normal or low weight	In a relationship	21,660 (51.0%)	4380 (19.6%)
Not measured ^a 12,672 (29.8%) 16,350 (73.0%) BMI (kg/m ²)	Missing	241 (0.6%)	59 (0.3%)
BMI (kg/m²) <25 normal or low weight	Not measured ^a	12,672 (29.8%)	16,350 (73.0%)
-25 normal or low weight 17,591 (41.4%) 10,090 (45.1%) 25-30 overweight 14,904 (35.1%) 8035 (35.9%) >30 obese 8708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 399 (1.8%) Overweight Missing 1295 (3.0%) 399 (1.8%) Overweight No 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) No 35,455 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder V V No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	BMI (kg/m²)		
25-30 overweight 14,904 (35.1%) 8035 (35.9%) >30 obese 8708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 399 (1.8%) Current smoking status 399 (1.8%) 399 (1.8%) Vo 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking 35,455 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder I I No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	<25 normal or low weight	17,591 (41.4%)	10,090 (45.1%)
>30 obese 8708 (20.5%) 3858 (17.2%) Missing 1295 (3.0%) 399 (1.8%) Current smoking status 1295 (3.0%) 399 (1.8%) Vo 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking 90 (0.4%) 90 (0.4%) Yes 7043 (16.6%) 3798 (17.2%) No 35,455 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.2%) History of psychiatric disorder I I No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	25–30 overweight	14,904 (35.1%)	8035 (35.9%)
Missing 1295 (3.0%) 399 (1.8%) Current smoking status No 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking 90 (0.4%) 90 (0.4%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder No 31,186 (73.4%) 18,472 (82.5%) Yes 0,0705 (25.2%) 3790 (16.9%) Missing 60 (1.4%) 120 (0.5%)	>30 obese	8708 (20.5%)	3858 (17.2%)
Korrent smoking status 20,279 (90.6%) No 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking 90 (0.4%) 90 (0.4%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder 7043 (16.6%) 3798 (17.0%) No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 60 (1.4%) 120 (0.5%)	Missing	1295 (3.0%)	399 (1.8%)
No 36,848 (86.7%) 20,279 (90.6%) Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking 90 (0.4%) 90 (0.4%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder 97043 (16.6%) 3798 (17.0%) No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	Current smoking status		
Yes 5236 (12.3%) 2013 (9.0%) Missing 414 (1.0%) 90 (0.4%) Habitual drinking	No	36,848 (86.7%)	20,279 (90.6%)
Missing 414 (1.0%) 90 (0.4%) Habitual drinking	Yes	5236 (12.3%)	2013 (9.0%)
Habitual drinking No 35,455 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder 3798 (17.0%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	Missing	414 (1.0%)	90 (0.4%)
No 35,455 (83.4%) 18,584 (83.0%) Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder	Habitual drinking		
Yes 7043 (16.6%) 3798 (17.0%) History of psychiatric disorder	No	35,455 (83.4%)	18,584 (83.0%)
History of psychiatric disorder No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	Yes	7043 (16.6%)	3798 (17.0%)
No 31,186 (73.4%) 18,472 (82.5%) Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	History of psychiatric disorder		
Yes 10,705 (25.2%) 3790 (16.9%) Missing 607 (1.4%) 120 (0.5%)	No	31,186 (73.4%)	18,472 (82.5%)
Missing 607 (1.4%) 120 (0.5%)	Yes	10,705 (25.2%)	3/90 (16.9%)
	Missing	60/ (1.4%)	120 (0.5%)

(Continued from previous page) Pre-existing comorbidity No $30,027$ (70,7%) $18,299$ (81.8%) Yes $12,156$ (28.6%) 3964 (17.7%) Missing 315 (0.7%) 119 (0.5%) Current depressive symptoms'
Pre-wisting comorbidityNo30,027 (7%)18,299 (8.%)No31,215 (28.6%)396 (47.7%)Mising30 (0.7%)119 (0.5%)Current depressive symptoms'No51,74 (85.%)29,397 (86.7%)Yes346 (12.8%)2644 (11.8%)Mising878 (2.1%)341 (1.5%)Current axiety symptoms'No318,805 (9.3%)21,416 (9.5%)No33 (0.6%)21,009 (5.4%)No33 (0.6%)20 (0.5%)Mising33 (0.8%)20 (0.5%)No11,63 (5.2%)116 (3.2%)No12,672 (2.8%)16,350 (7.3%)No measured*12,672 (2.8%)16,350 (7.3%)Jup-Sopt entior12,744 (30.0%)255 (1.0%)Jup-Sopt entior12,744 (30.0%)255 (1.0%)Jup-Sopt entior12,744 (30.0%)255 (1.0%)Jup-Sopt entior12,672 (2.8%)16,350 (7.3%)Jup-Soptember 202036 (0.3%)6 (0.0%)Jup-Soptember 202036 (0.9%)178 (0.8%)Jup-Soptember 202110,072 (2.7%)134 (6.4%)Jup-Soptember 202110,72 (2.7%)134 (0.6%)Jup-Soptember 202110,72 (2.7%)134 (0.6%)Jup-Soptember 202110,72 (2.7%)134 (0.6%)Jup-Soptember 2021
No 30.027 (70.7%) 18,299 (81.8%) Yes 12,156 (28.6%) 3964 (17.7%) Missing 1396 (17.7%) 100.05%) Current depressive symptoms' 19.397 (86.7%) 19.397 (86.7%) Yes 5446 (12.8%) 2644 (11.8%) Missing 2544 (12.8%) 2644 (11.8%) Missing 26.174 (85.1%) 20.90 (5.4%) Missing 3360 (7.9%) 21.146 (94.5%) Yes 3360 (7.9%) 20.90 (5.4%) Missing 33.00 (7.9%) 20.90 (5.4%) Missing 3360 (7.9%) 29.01 (9.1%) Missing 3360 (7.9%) 29.01 (9.1%) Missing 336 (0.8%)
Yes 12,56 (28,6%) 3964 (17,7%) Missing 315 (0.7%) 19 (0.5%) Current depressive symptoms"
Missing 315 (0.7%) 119 (0.5%) Current depressive symptoms ⁶
Current depressive symptoms ⁶ U No 36,174 (85.1%) 19,397 (86.7%) Yes 544 (12.8%) 2644 (11.8%) Missing 878 (2.1%) 341 (1.5%) Missing 878 (2.1%) 341 (1.5%) Current anxiety symptoms ⁶ 38,805 (91.3%) 21,146 (94.5%) Yes 3360 (7.9%) 1209 (5.4%) Missing 333 (0.8%) 27 (0.1%) Missing 333 (0.8%) 27 (0.1%) Ver 7961 (18.7%) 4840 (21.6%) Yes 7961 (18.7%) 163 (5.2%) Missing 334 (0.8%) 29 (0.1%) Not measured ⁶ 12,744 (30.0%) 235 (10.9%) July Co20 or earlier 12,744 (30.0%) 235 (10.9%) July September 2020 363 (0.9%) 163 (58.8%) July September 2020 363 (0.9%) 163 (0.9%) July September 2021 10,073 (3.7%) 484 (0.6%) January-March 2021 30,08%) 37 (0.2%) January Jose Color 7,172 (0.4%) 33 (1.9%) January March 2021
No36,174 (85.1%)19,397 (86.7%)Yes544 (12.8%)264 (11.8%)Mising876 (2.3%)264 (11.8%)Current anxiety symptoms ^d 31 (1.5%)Wes38,805 (91.3%)21,146 (94.5%)Yes3360 (7.9%)1209 (5.4%)Missing33 (0.8%)27 (0.1%)Current COVID-19 related distress symptoms ^d 27 (0.1%)Formet COVID-19 related distress symptoms ^d 4840 (21.6%)Yes7961 (18.7%)1163 (5.2%)Missing334 (0.8%)29 (0.1%)Not measured ^a 27,67 (2.9.8%)16,350 (73.0%)Not measured ^a 27,47 (20.9.8%)16,350 (73.0%)June 2020 or earlier12,744 (30.0%)235 (1.0%)June 2020 or earlier36 (0.9%)78 (0.8%)Juny-March 202136 (0.9%)37 (0.2%)Juny-Spetmber 2020363 (0.9%)1434 (6.4%)Juny-Spetmber 202110,072 (3.7%)434 (6.4%)Junary-March 202110,072 (3.7%)434 (6.4%)Junary 2022 or after17,172 (40.4%)19,451 (85.9%)Ilmess severity-time bedridden-15,027 (67.1%)Bedridden 1-6 days-15,027 (67.1%)Bedridden 1-6 days or more-1248 (9.6%)Missing1080 (4.8%)1080 (4.8%)
Yes5446 (12.8%)2644 (11.8%)Missing878 (2.1%)341 (15%)Current anxiety symptoms"Yes3360 (91.3%)21,146 (94.5%)Missing3360 (7.9%)209 (5.4%)Missing33 (0.8%)209 (5.4%)Ver3360 (7.9%)4840 (21.6%)Ver796 1 (18.7%)4840 (21.6%)Yes796 1 (18.7%)163 (5.2%)Missing34 (0.8%)29 (0.1%)Not measured"12,672 (9.8%)35 (10.0%)Not measured"12,744 (30.0%)235 (1.0%)Ipue 2020 or earlier12,744 (30.0%)235 (1.0%)July-September 202036 (0.9%)178 (0.8%)October-December 2020363 (0.9%)178 (0.8%)Juny-March 202110,072 (23.7%)434 (6.4%)July-September 202110,072 (23.7%)433 (1.9%)July-September 202110,772 (40.4%)13,451 (8.9%)Juny 2022 or after17,172 (40.4%)13,451 (8.9%)Juny 2022 or after17,172 (40.4%)13,451 (8.9%)Juny 2022 or after17,172 (40.4%)13,451 (8.9%)Image severity-time bedridden12,027 (67.1%)Mot bedridden 1-6 days-1248 (9.6%)Missing1248 (9.6%)1248 (9.6%)
Missing 878 (2.1%) 341 (1.5%) Incurrent axiety symptoms ^d 38,005 (91.3%) 21,146 (94.5%) Yes 3360 (7.9%) 20.90 (5.4%) Missing 330 (0.8%) 20.00 (5.4%) Tourrent COVID-19 related distress symptoms ^a 21,531 (50.7%) 4840 (21.6%) Ves 7961 (18.7%) 4840 (21.6%) Missing 334 (0.8%) 29 (0.1%) Not measured ^a 2,672 (29.8%) 163 (5.2%) Mussing 334 (0.8%) 29 (0.1%) June 2020 or earlier 12,744 (30.0%) 235 (10.9%) June 2020 or earlier 12,744 (30.0%) 37 (0.2%) June 2020 or earlier 12,744 (30.0%) 37 (0.2%) June 2020 or earlier 12,074 (30.9%) 163 (3.8%) June 2020 or earlier 12,074 (3.0%) 37 (0.2%) June 2020 or earlier 10,072 (23.7%) 1434 (6.4%) <t< td=""></t<>
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Illness severity—hospitalization
Not hospitalized - 20,670 (92.4%)
Hospitalized – 230 (1.0%)
Missing or not measured 1482 (6.6%)
Time since COVID-19 diagnosis
0–2 months – 3150 (14.1%)
3-5 months – 10,879 (48.6%)
6-9 months - 4822 (21.5%)
>10 months – 3242 (14.5%)
Missing – 289 (1.3%)
Vaccination status ^f
None 1358 (3.2%) 1074 (4.8%)
Partly or fully vaccinated 35,820 (84.3%) 20,329 (90.8%)
Missing 5320 (12.5%) 979 (4.4%)

^aAverage monthly income was not measured in Omtanke2020 (SE). Relationship status and current COVID-19-related distress symptoms were not measured in DBDS (DK). ^bMissing or abroad refers to either missing in four cohorts or reported as living abroad in C-19 Resilience (IS). ^cCurrent depressive symptoms were measured using Patient Health Questionnaire (PHQ-9), with recommended cut-off of ≥ 10 indicating Yes to potentially having this condition in all cohorts. ^dCurrent anxiety symptoms were measured using General Anxiety Disorder (GAD-7) in C-19 Resilience (IS), Omtanke2020 (SE) and MAP-19 (NO), while measured by Angst-Symptom-Spargeskemaet (ASS) in DBDS (DK), with a recommended cut-off of ≥ 10 indicating Yes to having this condition. ^eCurrent COVID-19-related distress symptoms were measured using the modified Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) with a recommended cut-off of ≥ 4 , and the PTSD checklist for DSM-5 (PCL-5), indicating Yes to having this condition. ^fEvaluated at the time of physical symptom response.

Table 1: Background characteristics of 64,880 study participants NOT diagnosed or diagnosed with COVID-19.



Fig. 1: Prevalence ratio (95% confidence interval) of severe physical symptom burden (PHQ-15 \geq 15) among individuals with COVID-19 compared with individuals NOT diagnosed with COVID-19 in the four cohorts, and a meta-analysis (l^2 43.2%)^a. ^aPrevalence ratios were adjusted for age, gender, residency, average monthly income, current smoking, BMI, pre-existing comorbidity, relationship status, habitual drinking, previous diagnosis of psychiatric disorder, and response period. Income was not available in Omtanke2020 (SE), and relationship status was not available in DBDS (DK).

difficult to comprehensively assess the long-term health impact of this infection. To our knowledge, this is one of the few largest cohort studies to quantify risks of common physical symptoms among individuals diagnosed with COVID-19 in the general population using



Fig. 2: Prevalence ratio (95% confidence interval) of severe physical symptom burden (PHQ-15 \geq 15) among people with COVID-19 compared with people NOT diagnosed with COVID-19, by illness severity (bedridden) according to time from diagnosis, a meta-analysis combining four cohorts^a. ^aNumber of study subjects per group is located in Supplementary Table S3. Individuals with missing information on time since diagnosis or illness severity were excluded from this analysis (as shown in Table 1). Prevalence ratios were adjusted for age, gender, residency, average monthly income, current smoking, BMI, pre-existing comorbidity, relationship status, habitual drinking, previous diagnosis of psychiatric disorder, and response period. Income was not available in Omtanke2020 (SE), and relationship status was not available in DBDS (DK).

validated assessment tool. Our finding of increased risk of long-term severe symptoms is consistent with previous studies mostly based on hospitalized patients²⁴ with a relatively short follow-up time of below²⁵⁻²⁷ or around²⁸ one year, and without a comparison to the population free of COVID-19.4,25,26,28 Consistent with our previous study,14 we utilized self-reported number of days bedridden in addition to hospitalization as a proxy for illness severity. As a result, we assessed severity of the acute phase of COVID-19 among non-hospitalized patients (92.4% of the COVID), which is usually not targeted in existing studies.7,29 Individuals with severe acute COVID-19, particularly those who were bedridden 7 days or longer (9.6% of the COVID group) or hospitalized (1.0% of the COVID group), had a greater increase in prevalence of severe symptoms, while those with a milder infection (not bedridden at all) showed none or only a marginal (bedridden 1-6 days) increase in such prevalence. The finding on no risk increase among persons with milder infection was not in line with previous reports from early in the Pandemic³⁰ or where only hospitalization has been used as proxy of illness severity.5 Inconsistent with previous findings showing higher risk in women,9 we noted comparable prevalence increase in physical symptom burden among males and females. These differences in finding may be, at least partly, be due to reliance on electronic health records in many previous reports indicating increased health care seeking behaviour among women after COVID-19³¹ while the direct symptom assessments in our study suggests comparable rise in physical symptom prevalence across genders. We found an even higher prevalence increase for individuals without depression or anxiety symptoms indicating that the association between severe acute COVID-19 illness and risks of longterm physical symptoms may be independent of such mental health symptomology. The long-term health impact of severe COVID-19 is consistent with a recent hospital-based study from Italy, showing highly elevated prevalence in symptoms one year after acute illness.28 The ultimate duration of the risk increase remains unclear, and studies including long-term follow-ups are needed. Research from previous coronavirus outbreaks indeed indicates similar persistence of physical symptoms among survivors of SARS-CoV-1 (SARS), Middle East respiratory syndrome coronavirus (MERS), and acute respiratory distress syndrome (ARDS), including musculoskeletal pain, chronic fatigue, and exercise intolerance up to 5 years after infection.32-35

Similar to previous studies,^{4–7,9,25,36,37} our findings indicate that shortness of breath, headaches, chest pain, dizziness, and low energy/fatigue may be core symptoms of Long COVID. The comparison on the magnitude of the increase in specific symptoms is difficult across studies that lack a proper comparison to individuals without COVID-19,^{4,29} as well as use different methods to quantify the symptoms. The findings on



Fig. 3: Prevalence ratio (95% confidence interval) of individual physical symptom severity among people with COVID-19 compared with those NOT diagnosed with COVID-19, by each physical symptom^a. A. COVID-to-non-COVID cross-sectional comparison (all cohorts). B. Post-to-Pre COVID longitudinal comparison (Omtanke2020, N = 398). ^aPrevalence ratios were adjusted for age, gender, residency, average monthly income, current smoking, BMI, pre-existing comorbidity, relationship status, habitual drinking, previous diagnosis of psychiatric disorder, and response period. Income was not available in Omtanke2020 (SE), and relationship status was not available in DBDS (DK). Menstrual cramps were only applied to women aged <60 years. P-values were corrected for multiple testing using Bonferroni correction method. *Indicates corrected P-value <0.05; **<0.01; ***<0.001.

sustained increased prevalence of various symptoms after COVID-19, particularly after a severe course of acute illness, may be explained by several potential Although hyperactivity of proinmechanisms. flammatory cytokine response during the acute stage of the infection is observed,³⁸ the chronic inflammation following the acute disease phase is more likely to be associated with the persistent physical symptoms over 2 years. The circulating anti-nuclear autoantibodies are reported to form for individuals with COVID-19,39-41 which cause inflammation and damage to multiorgans, leading to various autoimmune diseases. For instance, elevated levels of IL-1 β , IL-6, IL-8 and TNF- α persisting after recovery from COVID-19 infection have been suggested to cause long-term COVID-19 symptoms.³⁹ The chronic inflammation following acute infection can lead to alveolar damage in the lungs as well as microvascular injury.^{38,42} Also, there is suggestive evidence that some individuals do not completely clear the virus over time, resulting in persistent viral load in the body and chronic symptoms.43 Similar mechanisms have been found in other inflammatory diseases, such as rheumatoid arthritis where prolonged elevated TNF- α has been associated with development of fatigue. Taken together, the prolonged symptoms following COVID-19 are likely to manifest multi-organ involvement,44 although these mechanisms are not fully understood. Further research is therefore needed to understand the long-term effects of the infection whereas sustained clinical surveillance on long-lasting physical symptoms is needed, by taking into account acute illness severity and time since diagnosis. The heterogeneity of the reported COVID-19 associated physical symptoms from existing literatures challenges the understanding of underlying pathophysiology. Thus, our findings shed further lights on narrowing the range of these symptoms and, thereby, basis for more for targeted surveillance and interventions, as well as resource allocation from the policy point of view.

Strengths and limitations

The strengths of our study include the large sample size with more than 22,000 persons diagnosed with COVID-19 with varying acute illness severity, as well as a large comparison group without COVID-19, across four Nordic countries. We were able to use detailed information on illness severity and time since diagnosis to investigate the association according to illness severity over time, with adjustment for a list of selected covariates. The validated questionnaire used to quantify the severity of physical symptoms enabled us to comprehensively assess the severe physical symptom burden, overall and individually. The more than 2-year follow-up provided, so far, the longest assessment on risk of persistent severe symptoms after infection with SARS-CoV-2. We were able to directly compare severe

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Fig. 4: Prevalence ratio (95% confidence interval) of reporting *bothered a lot* to each symptom among people with COVID-19 compared with those NOT diagnosed with COVID-19 in C-19 Resilience, Omtanke2020 and DBDS, by illness severity (bedridden) according to time from diagnosis^a. ^aPrevalence ratios were adjusted for age, gender, residency, average monthly income, current smoking, BMI, pre-existing comorbidity, relationship status, habitual drinking, previous diagnosis of psychiatric disorder, and response period. Income was not available in Omtanke2020 (SE), and relationship status was not available in DBDS (DK).

symptoms before and after COVID-19 diagnosis in a subset of Omtanke2020 participants, demonstrating a longitudinal impact of acute illness on participant's physical health.

There are also some limitations to be noted. First, our study relies on self-reported information on COVID-19 diagnosis and physical symptoms, and therefore may suffer from recall bias, meaning that participants may not remember all the details of their illness. This will likely have diluted the results toward null. Second, individuals with COVID-19 may be more prone to report symptoms than the non-COVID group. Yet, the null association observed in the group who were diagnosed with COVID-19 but were not bedridden alleviates this concern to some extent. Third, the varying time periods of data collection in the four cohorts coinciding with the different pandemic waves and respectively different virus variants may result in substantial differences across cohorts in comparisons of physical symptoms between COVID and non-COVID groups. We adjusted for the response period in the multivariable models to control for this discrepancy and the similar positive associations noted across the four cohorts argue against our findings being explained entirely by these factors. The smaller

prevalence increase in DBDS and MAP-19 may be due to the larger proportion of participants likely infected with the omicron variant, than other cohorts, this coincides with a higher likelihood of being partly or fully these data collection vaccinated in waves (Supplementary Figure S3). Fourth, despite consistent positive overall associations noted in each cohort, we found the prevalence increase of severe symptoms to be smaller in DBDS than C-19 Resilience (26% vs. 60% increase in prevalence). The DBDS cohort is comprised of active or former blood donors, presumably healthier than the general population. This healthy donor effect may partly explain the smaller prevalence increase observed in DBDS, compared to the other cohorts, and may result in an underestimated overall association when combining results of all cohorts. Apart from the abovementioned differences in the cohorts, the potential protective effect of the COVID-19 vaccine might also have played a role in participants with a late response period in Omtanke2020, MAP-19, and DBDS. Evidence has indeed shown reduced physical symptoms among fully vaccinated individuals.28,45 The majority of the participants in each of these cohorts reported being partly or fully vaccinated, and sensitivity analysis in C-19

Resilience and Omtanke2020 showed largely similar results when restricting to vaccinated individuals only (Supplementary Tables S4 and S5). Lastly, our findings should be generalized with caution to other populations or countries with different societal, background, or healthcare systems than Nordic countries.

Conclusion

This multinational study of persons with COVID-19 in four Nordic countries indicates that severe acute illness of SARS-CoV-2 infection is an important predictor of persistent physical symptoms, e.g., shortness of breath, chest pain, dizziness, headaches, and low energy/fatigue, up to 27 months after diagnosis. These findings highlight the importance of continued monitoring and alleviation of the identified core physical symptoms, at least during the first 2 years after diagnosis, among individuals suffering severe forms of COVID-19.

Contributors

The participating COVIDMENT cohorts and/or their data collections were designed by QS, EEJ, OVE, MD, OBVP, SUJ, FF, UAV, and their respective teams. UAV, QS, and TA directed the combined effort of this study implementation. UAV, QS, EEJ, and TA designed the analytical strategy in close collaboration with all team members and all authors helped to interpret the findings. QS, EEJ, OVE, and MD conducted the literature review and drafted the manuscript under supervision of UAV. All authors revised the manuscript for critical content and approved the final version of the manuscript.

Data sharing statement

The individual-level data underlying this article were subject to ethical approval and cannot be shared publicly due to data protection laws in each participating country.

Declaration of interests

OAA receives support from the NordForsk (grant number 105668 COVIDMENT) and the European Union's Horizon 2020 Research and Innovation Programme (Grant 847776; CoMorMent). OAA declares receiving grants or contracts from NIH NIMN Award (R01MH123724-01, 1R01MH124839, 1R01MH129742, 1R01MH129858-01A1), Research Council of Norway (RCN grants 223273, 296030, 300309, 324252), the South-East Norway Health Authority (grant 2017-112, 2022-073), European Union's Horizon 2020 Research and Innovation Programme (Grant 964874 REALMENT), EEA-RO-NO-2018-0535, and KG Jebsen Stiftelsen (grants SKGJ-MED-008 and SKGJ-MED-021). OAA receives consulting fees from Biogen, Cortechs.ai and Milken. OAA gets Speaker's honorarium from Janssen, Lundbeck and Sunovion, and has a patent on Intranasal Administration (US20160310683 A1). OAA participated in advisory board as National PI for JANSSEN trial depression, MAPS trial PTSD and BI trial schizophrenia. OAA declares having stock at Cortechs.ai. RP receives grant of Excellence, Icelandic Research Fund. RP declares to be the vice president at UEMS Section of Internal Medicine, a board member of the Icelandic Society of Internal Medicine, and is the president of the Icelandic Transplantation Society. EF received a payment for keynote lecture from Astra Zeneca. SUJ is a leader in Metacognitive Therapy Institute Norwegian Branch. FF receives support from the NordForsk (grant number 105668 and 138929 COVIDMENT) and the Horizon 2020 (Grant 847776; CoMorMent). UAV receives support from the NordForsk (grant number 105668 and 138929 COVIDMENT) and the Horizon 2020 (Grant 847776: CoMorMent). AL declares to receive Fredrik and Ingrid Thuring Foundation. OBVP receives Independent Research Fund Denmark (0214-00127B). QS declares receiving support from the Outstanding Clinical Discipline Project of Shanghai Pudong (Grant No.: PWYgy2021-02) and the Fundamental Research Funds for the Central Universities. PFS declares receiving funding from the Swedish Research Council (Vetenskapsrådet, award D0886501). PFS also receives consulting fees, participating on a data safety monitoring board or advisory board, and holds stock or stock options, from Neumora Therapeutics. All other authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lanepe.2023.100756.

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