NHS RACE & HEALTH OBSERVATORY

REACH-OUT: Caring for the healthcare workforce post-COVID-19

A longitudinal mixed-methods study of post-COVID-19 outcomes in healthcare workers from diverse ethnicities

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List of abbreviations

AHP	Allied health professional
aORs	Adjusted odds ratios
BMI	Body Mass Index
CDC	Centres for Disease Control and Prevention
CI	Confidence intervals
COVID-19	Coronavirus disease-2019
CVDs	Cardiovascular diseases
COPD	Chronic obstructive pulmonary disease
GDC	General Dental Council
GMC	General Medical Council
GOC	General Optical Council
GPC	General Pharmaceutical Council
HCPC	Health and Care Professions Council
HCWs	Healthcare workers
HR	Human Resources
HRA	Health Research Authority
HSS	U.S. Department of Health and Human Services
IMD	Index of Multiple Deprivation
IQR	Interquartile range
JBI	Joanna Briggs Institute
MeSH	Medical Subject Headings
NA	Not available
NASEM	National Academies of Sciences, Engineering, and Medicine
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NMC	Nursing and Midwifery Council
ONS	Office for National Statistics
ORs	Odds ratios
PASC	Post-acute sequelae of SARS-CoV-2 infection
PEP	Professional Expert Panel
PHOSP-COVID	Post-hospitalisation COVID-19 UK-multicentre study
PIS	Participant Information Sheet
PCC	Post-COVID condition
PRESS	Peer Review of Electronic Search Strategies
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses statement
PROSPERO	Prospective Register of Systematic Reviews
PSNI	Pharmaceutical Society of Northern Ireland
RECOVER	Researching COVID to Enhance Recovery
REDCap	Research Electronic Data Capture
REC	Research Ethics Committee
UK	United Kingdom
UKRI	UK Research and Innovation
UK-REACH	United Kingdom - Research Study into Ethnicity and COVID-19 Outcomes
WHO	World Health Organization

EXECUTIVE SUMMARY

BACKGROUND

The COVID-19 pandemic brought unprecedented challenges to healthcare systems worldwide. Healthcare workers (HCWs) were at the forefront of the pandemic and faced greater risk of contracting COVID-19 due to close and prolonged contact with infected individuals. Yet most of the existing research on long COVID (defined as signs and symptoms that continue or develop after acute COVID 19) has focused on the general population rather than on HCWs. This leaves gaps in our understanding of how demographic, clinical, occupational and sociocultural factors - with specific attention to ethnicity, migration status and vaccination history - could impact on long COVID risk, prevalence, and outcomes among HCWs. This three-year research project aimed to address this gap.

OBJECTIVES

- Quantify the prevalence of long COVID among HCWs globally, and in the UK specifically, and characterise the most common symptom clusters of long COVID in HCWs.
- Identify demographic, clinical, occupational and sociocultural factors associated with risk of long COVID, with specific attention to ethnicity, migration status and vaccination history.
- Explore the lived experiences of ethnically diverse HCWs with long COVID, including the mental, physical and occupational impacts of long COVID on individuals, individual coping mechanisms and organisational responses to long COVID in HCWs.
- Generate actionable recommendations for practice, policy and future research to safeguard workforce sustainability and equitable care.

METHODS

Our mixed-methods research comprised four studies:

- **Global systematic review and meta-analysis** of 28 studies that included a total of 6,481 HCWs for data searched between31 December 2019 and 18 February 2022, estimating the prevalence of long COVID among HCWs and the most common long COVID symptoms clusters among HCWs.
- **Cross-sectional analysis of early pandemic (December 2020 to March 2021) questionnaire data** from 11,513 UK HCWs, estimating the prevalence of long COVID (symptoms for 5 weeks or longer) among those with a history of SARS-CoV-2 infection.
- **Cross-sectional analysis of later pandemic (October 2021 to October 2022) questionnaire data** from 4,137 UK HCWs, estimating the prevalence of long COVID (symptoms for 12 weeks or longer) among those with a history of SARS-CoV-2 infection, and incorporating vaccination and SARS CoV-2 variant data, to explore symptom risks and patterns, and differences in risk of symptom clusters by ethnicity and other demographic characteristics.

- **Qualitative research (December 2023 to May 2024)** with 24 HCWs, 13 managers and 5 support network members exploring the mental, physical and occupational impacts of long COVID, and individual coping and organisational responses.

KEY FINDINGS

Prevalence and Symptom Burden

- The combined results of multiple studies from around the world found that **40% of HCWs who had been infected with SARS-CoV-2 had long COVID.** These HCWs were followed up in their prospective studies for an average of 22 weeks after their initial COVID-19 symptoms or infection. Among HCWs followed up for 12 months (52 weeks) **26.5%** had long COVID.
- **Fatigue** (35%), **neurological symptoms** such as "brain fog" and headaches (25%), **loss of taste and/or smell** (25%), **muscle pain** (22%) and **shortness of breath** (19%) were the most common symptoms of long COVID among HCWs globally.
- Of those UK HCWs who took part in our national questionnaire study, approximately one quarter infected with SARS-CoV-2 had long COVID. This included 23% surveyed between December 2020 and March 2021 who had symptoms for 5 weeks or longer, and 27% surveyed between October 2021 and October 2022 who had symptoms for 12 weeks or longer.

Risk Factors

- In our questionnaire studies, the HCWs most likely to report long COVID were female; working in nursing, allied-health or administrative roles; had self-reported comorbidities; or had had severe acute COVID-19.
- Vaccination against COVID-19 showed a dose-response protective effect against long COVID: the more vaccine doses a HCW had, the lower their odds of having long COVID.
- HCW's ethnic and migration background was associated with their experience of long COVID: some minority groups showed lower overall prevalence and risk of long COVID compared to the White British group, but we found evidence that symptom profiles may be shaped by cultural norms and exposure patterns that played a role in their perception of the condition and symptoms reporting, influencing the accuracy and completeness of symptom data.

Impact of long COVID on the Workforce

- Findings from our interview study indicated that long COVID significantly contributed to absenteeism, presenteeism and reduced productivity among HCWs.
- HCWs affected by long COVID described the response to long COVID from NHS organisations employing HCWs as **"inconsistent and insufficient".**

Lived Experience

HCWs with long COVID, and their managers, had experiences that were characterised by the following themes:

- **Challenges for HCWs of living and coping with unpredictable symptoms** – cycles of relapse, fatigue and cognitive "brain fog".
- **Guilt, stigma and blame experienced by HCWs** – internalised pressure among HCWs to "keep going" and fear of being perceived as malingering.
- **Limited understanding of long COVID**– ongoing uncertainty among clinicians and managers about prognosis and evidence-based management.
- **Need for improved workplace adjustments** – phased returns, redeployment and the strain on colleagues covering gaps.

RECOMMENDATIONS

For Practice

- NHS Trusts should implement flexible return-to-work pathways such as reduced hours and hybrid working, that are tailored to enable HCWs to manage fluctuating symptoms.
- HCWs should have rapid access to multidisciplinary long COVID clinics and psychological support that are designed specifically for the particular needs of HCWs. For example, clinics located within hospitals or accessible remotely to avoid additional travel or disruption to clinical rotas. Services should also be timely, confidential, and sensitive to the stigma HCWs may face when seeking help for an ofteninvisible condition and avoid career disadvantage due to health disclosures.

For Policy

- Long COVID assessment and case management for HCWs should be standardised across the NHS. At present, access to assessment and care for HCWs with long COVID is inconsistent, with considerable variation in eligibility criteria, referral processes, diagnostic protocols, and support offered across different NHS Trusts.
- The collection of ethnicity and occupation data in surveillance systems should be mandated, to monitor inequities for those with long COVID.
- Sickness absence protections should be extended for HCWs suffering from long COVID, to avoid financial penalties that lead to premature returns.

For Research

- Consensus is required on case definitions and core-outcome sets for long COVID in working-age adults.
- Longitudinal studies are needed to track long COVID recovery trajectories beyond 24 months and evaluate interventions such as antivirals and rehabilitation on long COVID recovery.
- Participatory research with ethnically diverse HCWs and their organisations should be undertaken to co-design and evaluate culturally sensitive support models.

1.INTRODUCTION

Key Points

- Key points COVID-19 is caused by SARS-CoV-2 and has resulted in substantial mortality and morbidity globally and in the UK.
- Some people experience persistent or new symptoms beyond acute infection, now commonly grouped under the umbrella term “long COVID.”
- Definitions vary and have evolved across organisations (e.g., NICE, WHO, HHS, NASEM), typically using time thresholds ranging from 4–12 weeks to ≥3 months; this report specifies which definition is used in each study.
- Long COVID is heterogeneous and multi-system, with 200+ reported symptoms; common symptoms include fatigue, cough, headache, loss of taste/smell, cognitive symptoms (e.g., “brain fog”), and mental health impacts.
- Evidence suggests long COVID may be under-recognised/under-recorded in routine clinical data despite symptom reporting in population studies.
- UK data indicate a substantial, prolonged burden, with many individuals reporting symptoms lasting over a year and significant impacts on daily functioning, alongside reports of limited understanding and support.
- The NHS response has progressed from early plans and investment (2020–2021) to subsequent service expansion and updated guidance/ commissioning arrangements (2022–2024), including specific guidance for NHS staff affected by long COVID.

1.1 Understanding long COVID

Coronavirus disease-2019 (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus.1 In the United Kingdom (UK), there were over 25 million confirmed cases of COVID-19 as of November 2024.[2]

In the months after the start of the COVID-19 pandemic, evidence started emerging that some patients with COVID-19 experienced long-term symptoms and complications that extended beyond the acute phase of infection.[3] These persistent symptoms are now widely known under the umbrella term ‘long COVID’.[4,5]

The definition of long COVID continues to evolve as understanding of the condition develops. We have summarised the main definitions created by governmental and non-governmental organisations which are based on clinical criteria, including the most recent working definition of long COVID, [7] in **Table 1.1.**

Understanding of long COVID continued to evolve throughout our research, which started before the definitions in **Table 1.1.** were published. We therefore have used two different long COVID definitions, and we specify in each study the definition used.

Table 1.1. Definitions of long COVID

Source	Date (Month, Year)	Term used	Definition
UK National Institute for Health and Clinical Excellence NICE) 8	2021	Long COVID	Signs and symptoms that continue or develop after acute COVID 19. It includes both ongoing symptomatic COVID 19 (from four to 12 weeks) and post COVID 19 syndrome (12 weeks or more).
US Department of Health and Human Services (HHS) 9	August 2022	Long COVID	Signs, symptoms, and conditions that continue or develop after initial COVID-19 or SARS-CoV-2 infection.
World Health Organization (WHO) 10	February 2023	Post COVID-19 condition (Long COVID)	The continuation or development of new symptoms three months after the initial SARS-CoV-2 infection, with these symptoms lasting for at least two months with no other explanation.
National Academies of Sciences, Engineering, and Medicine (NASEM) 7	July 2024	Long COVID	An infection-associated chronic condition that occurs after SARS-CoV-2 infection and is present for at least three months as a continuous, relapsing and remitting, or progressive disease state that affects one or more organ systems.

1.1.1 Symptoms of long COVID

The symptoms after acute COVID-19 infection are heterogeneous and wide ranging.[5]

Growing evidence shows that long COVID can damage multiple organ systems, even in less vulnerable populations (e.g., young people) with respiratory, cardiac, and neurologic organ systems among the most frequently damaged.[11]

More than 200 symptoms of long COVID have been identified.[12]

The most common symptoms include: [3,13,14]

- fatigue,
- cough,
- headache,
- loss of taste and/or smell,
- cognitive (e.g., "brain fog"), and
- mental health illnesses such as anxiety and depression.

Long COVID symptoms maybe under-reported or under-recognised. For instance, a large population-based longitudinal cohort study in England which analysed data from over 1.5 million individuals with confirmed SARS-CoV-2 infection found that 7.4% of individuals experienced at least one long COVID symptom beyond the acute phase, but only 0.5% had a documented diagnosis of long COVID.[15]

Despite the growing body of research on long COVID symptoms, recurrence, and prevalence, many of the persistent symptom profiles are less well understood and researched than those experienced during the acute phase of COVID-19.[16]

The aetiology underlying the symptoms of long COVID is also unclear.[17]

1.1.2 Risk factors for long COVID

A number of studies have found that risk factors for long COVID for patients infected SARS-CoV-2 include: [3,23–25]

- female sex,
- ethnicity minority groups,
- comorbidities,
- body mass index (BMI),
- socioeconomic status, and
- smoking

It is however the case that long COVID can occur across all ages, genders, ethnic groups, and can occur among people who were previously healthy, fully vaccinated, or who experienced only mild or asymptomatic acute COVID-19 illness.[27–32]

Most people living with long COVID had mild or moderate initial illnesses that did not require hospitalisation.[34–36] It is worth noting that hospitalisation for acute COVID-19 was rare even during the early pandemic waves (2.5% of cases in 2020 and 1.3% in 2021),33 which may be because their disease was not severe

enough, however it may also be because they did not seek care or were turned away due to poor understanding of the disease and rationing of resources.[37]

1.2 The long COVID landscape in the UK

According to data from the UK Government Office for National Statistics (ONS) in April 2024, over two million individuals in the UK reported experiencing COVID-19 symptoms for longer than four weeks, of whom 61% had symptoms for over a year and 35% two years or longer.[44] A national population study conducted in 2022 of nearly 2 million Scottish adults were around half of whom had been infected with SARS Cov-2. Of which, 14% had at least one symptom attributable to long COVID at 6 months, 13% at 12 months and 16% at 18 months.[45]

1.2.1 NHS policy response and guidance

Early response

As an initial response to the challenge of long COVID, in October 2020 the NHS set out a five-point plan to enhance NHS support to patients experiencing long-term effects of COVID-19.[52] The plan included: [52]

- additional funding for post-COVID assessment services,
- research on long COVID to better understand the condition and refine appropriate treatment,
- an online platform to provide general information on all aspects of recovering from COVID-19, and
- an NHS long COVID taskforce including people with lived experience of long COVID, NHS staff and researchers.

The Long COVID Plan 21/22

In June 2021, the NHS outlined a further ten key next steps in 'The Long COVID Plan 21/22', which included a £100 million investment to build on the 5-point plan.[53]

It focused on: [53]

- enhancing services for general practice to support long COVID care and expand other NHS long COVID services.Click or tap here to enter text.
- equity of access, outcomes, and experiences by collecting data on ethnicity, gender, and deprivation against expected prevalence of long COVID.
- Underlying support for NHS staff suffering from long COVID.

NHS England long COVID guidance for staff and commissioning arrangements

In July 2022, NHS England drafted guidelines for supporting NHS staff affected by long COVID that included details on what long COVID is, advice on sick pay, and how to record long COVID-related absence, as well as other support services for those who suffer from long COVID.[54]

Later, the NHS's £90 million investment in 2022/23 aimed to expand long COVID services broadly without addressing the unique challenges HCWs face.[55]

Updated NHS guidance in 2023 emphasised equity through integrated care pathways with a transition to Integrated Care Boards by April 2024, focusing on service sustainability but not prioritising HCWs within these frameworks.[55]

1.3 Race, ethnicity, and long COVID

1.3.1 Definition of key terms: race, ethnicity and ethnic minorities

Historically, "race" and "ethnicity" are socially constructed terms that have been constantly evolving. Race is defined based on physical characteristics such as skin, hair, or eye colour,56 while ethnicity refers to "the social group a person belongs to, and either identifies with or is identified with by others, as a result of a mix of cultural and other factors including language, diet, religion, and physical features traditionally associated with race".[56] This distinction highlights the broader cultural and social dimensions encompassed by ethnicity.[56]

The term "ethnic minorities," as used by the UK government, refers to all ethnic groups except the White British group. It includes White minority groups such as Gypsy, Roma, and Irish Traveller communities.[58]

1.3.2 Classification of ethnicity

Currently, the Office for National Statistics (ONS) in the UK classifies ethnicity using the five high-level ethnic groups: "Asian, Asian British or Asian Welsh," "Black, Black British, Black Welsh, Caribbean or African," "Mixed or Multiple ethnic groups," "White," and "Other ethnic group."[59] This classification was used in the most recent Census (2021).[59] These broad categories are complemented by a second level of more specific sub-groups to provide further detail when needed. For example, within the "Asian, Asian British or Asian Welsh" category, a specific subgroup can be identified as "Pakistani."[60] This can be expressed as "Asian, Asian British or Asian Welsh: Pakistani" or simply "Pakistani within the 'Asian, Asian British or Asian Welsh' ethnic group."[60] These classifications are designed to ensure flexibility and inclusivity in representing the UK's diverse population.

1.3.3 Ethnicity terminology and classification in this report

Through this report, we use the collective term 'ethnic minority' when referring to groups who are not White British. We acknowledge that this term is imperfect and contested. Where possible, we have been specific about the ethnic groups in question and have only used collective terms where absolutely appropriate.

We classified ethnicity in our cross-sectional analyses according to the 5- and 18-level ethnic group categories provided by the UK's ONS.114 We used the 5-level variable (White, Asian, Black, Mixed, and Other) to balance maximising statistical power for detecting differences between ethnic groups with heterogeneity within each ethnic group.

1.3.4 Ethnicity and risk of COVID-19 among HCWs

The NHS workforce is ethnically diverse. As of June 2022, 74.3% were White, 12.5% were Asian, 7.4% were Black, followed by 3.0% Other and 2.1% from Mixed ethnicities.[61] This is compared to the general population of England and Wales where in 2021, 81.7% identified as "White", 9.3% as "Asian, Asian British or Asian Welsh" 4.% as "Black, Black British, Black Welsh, Caribbean or African" and 2.9% as being of "Mixed or Multiple" ethnic groups.[59]

As for migration status, the NHS has increasingly relied on international recruitment to address staffing shortages. Data from March 2019 shows that 12% of the healthcare workforce in NHS hospitals in England where 6% were non-UK EU nationals and 6% non-EU nationals.64 Notably, higher proportions of doctors (29%) and nurses (18%) were non-British nationals.[64] In 2022, half of the secondary care doctors registered with the General Medical Council in England had received their primary medical qualification abroad.[65]

In the UK, ethnic minority healthcare workers (HCWs) played a crucial role in the COVID-19 response, representing 25.7% of NHS staff and 49.9% of hospital and community health services doctors.[62] These groups were also more affected by COVID-19.[62] Early in the pandemic, 63% of health and social care worker deaths were among ethnic minority HCWs, which is three times their representation in the NHS workforce.[63] A study of data from over 2 million individuals in the UK and US using the COVID-19 Symptom Study mobile application between 24 March and 23 April 2020, found front-line HCWs had at least a threefold higher risk of testing positive or having predicted COVID-19 compared with the general community after adjusting for other factors.[66] Black, Asian, and minority ethnic HCWs faced an even higher risk, with at least a fivefold increased risk compared with non-Hispanic[2] White members of the general community.[66] A UK cohort study of over 10,000 HCWs estimated around 23% who worked in March 2020 reported previous SARS-CoV-2 infections, and Black HCWs were more likely to have been infected than White HCWs.[67] Despite the key role HCWs played during the pandemic, limited attention has been given to how COVID-19 has affected ethnic minority HCWs post the acute phase, both at home and work.

1.3.5 Ethnicity and long COVID

ONS analyses indicated that the prevalence of self-reported long COVID was higher among certain ethnic groups. During the second wave of the pandemic (1 September 2020 to 22 May 2021), individuals from Pakistani and Bangladeshi ethnic backgrounds had higher odds of testing positive for COVID-19 compared to the White British group.[68]

Some studies have also reported an elevated risk of long COVID among specific ethnic groups, including Black Afro-Caribbean and other minority ethnic groups (e.g., Middle Eastern, Native Americans, and Polynesians).[24] Despite the fact that the few studies on long COVID that include data on ethnic minorities show that

[1] Nationals of countries that were EU members prior to 2004, for example, France, Germany and Spain, are termed the EU15; Central and Eastern European countries that joined the EU in 2004, for example, Poland, are termed the EU8; EU2 comprises Bulgaria and Romania, which became EU members in 2007.

they are disproportionately affected by long COVID, data on ethnic minorities is lacking in European countries and globally.[63]

The ONS has not published specific data on the prevalence of long COVID among different migrant populations.[46] However, it is recognised that factors such as socioeconomic status, occupation, and access to healthcare—which can vary among migrant groups—may influence both the risk of COVID-19 infection and the likelihood of experiencing long COVID.[46,63]

1.4 Social and occupational context for long COVID among HCWs

Long COVID occurs after SARS-CoV-2 infection, so the social and occupational conditions that increased HCWs' exposure or made them worse are central to understanding its burden. The COVID-19 pandemic has placed significant pressure on health systems. Globally, HCWs have faced heightened mental and physical risks while working in challenging conditions.[69,70]

Beyond close exposure to patients, long hours, difficult triage decisions, fear of the unknown, PPE scarcity, ongoing viral mutations, rising deaths, inequitable vaccine rollout, and pressure on services pushed many towards a "tipping point.".[38,75–78] Working on COVID-19 wards and/or witnessing COVID-related deaths increased risks of depression and anxiety, with concerns about burnout and suicide.[79–81] According to an International Council of Nurses survey in 2020, approximately 10% of HCWs were infected with COVID-19 globally.82 In 2020, the WHO estimated that more than 152,000 infections and 1,400 deaths were reported among HCWs.83 This suggests that one HCW died for every 100 who became infected.83 But due to under-reporting of COVID-19 infections, the actual number of infections is likely to be significantly higher in this population.83

There is further evidence that HCWs, especially those from ethnic minority backgrounds, may be at particularly high risk of poor physical and mental health outcomes.[38] A living systematic review (97 studies, 2020) reported substantial morbidity among HCWs; those in non-emergency wards and nurses were most often infected. Estimated prevalence by RT-PCR and serology was 11% (95% CI 7–15) and 7% (4–11), respectively; nurses comprised 48% of infections (41–56).[84]

Qualitative syntheses from the first year of the pandemic describe poor physical and mental health: tiredness, sleep problems, skin damage, stress, depression, anxiety, fear, anger, and uncertainty—linked to new work demands, PPE shortages/burdens, heavier workloads, concerns about care quality, and ethical dilemmas.[85]

"Non Hispanic" is a U.S.-specific ethnicity category and is not a standard classification in the UK.

Long COVID directly affects workforce sustainability. Returning HCWs report fatigue, cognitive symptoms, and breathlessness that hinder normal duties.[89] It also contributes to staff shortages via prolonged sick leave, reduced hours, and early retirement.[91] Within the NHS, 92.7% of staff with long-COVID symptoms took sick leave; mean sick days fell from 14 (2021) to 7 (2023), and long-term sick leave from 20.8% to 4%, changes that may reflect the end of special sick-pay provisions rather than improved health.[92]

1.5 long COVID and HCWs

1.5.1 Key points

- Across studies of HCWs in the globe, risk factors, prevalence, and symptomology vary, and findings on individual risk factors are inconsistent, reflecting a complex relationship of demographic, health, occupational and infection-related influences.[93]
- Evidence on mental, physical health, and impacts of long COVID among HCWs is limited.[93]

1.5.2 Global evidence

- For gender, women often report more symptoms than men.[94]
- For occupation, patient-facing staff, especially nurses seem to report more symptoms than physicians, with the most common symptoms including fatigue, dyspnoea and cognitive difficulties.[94] In Europe, older age, female sex, and immunosuppression were common risk factors for HCWs.[95]
- In Spain, female sex, overweight/obesity, and workplace exposure were key risks in primary care HCWs.[95 97]

1.5.3 UK evidence

- In UK cohorts, persistent symptoms (>12 weeks) were common after first infection and were dominated by fatigue, breathlessness and concentration problems; risks factors included, patient-facing roles and those with pre-existing conditions.[98]
- The burden appeared higher in the Wild-type period than during Omicron, and vaccination was associated with fewer persistent symptoms. 98 99
- Despite substantial symptom reporting, relatively few HCWs had a formal long-COVID diagnosis.[99]

1.5.4 Impacts on health and workforce

Mental and physical health

- Research into the long-term effects of work stress among HCWs in the “post-COVID era” revealed a direct correlation between mental health deterioration and increased work-related stress (coefficient: 0.010, $p < 0.001$).[102] This same study observed that HCWs with poorer mental health experienced reduced rest time (coefficient: 0.007, $p < 0.001$).[102] Long COVID has resulted in substantial work absences and modifications to work patterns. Evidence shows that perceived work ability among HCWs decreased compared to a time before they became infected by COVID-19.[107]

Occupational impacts

- In the UK, 18% of doctors with long COVID had not returned to work; 40% required a phased return or amended duties. Females more often reported extended phased return (45% vs 28%) and occupational assessments (43% vs 33%).[109]
- Another UK study reported that 3 HCWs (4.9% of those with post-COVID syndrome) needed additional sick leave, and 69% felt they were struggling to cope.[110]

1.6 Summary and research rationale

Prior to our study, the evidence showed that long COVID was widespread, with 31–54% estimated to have persistent symptoms, with more than 200 documented symptoms affecting multiple organ systems, and still poorly understood in terms of diagnostic criteria, definition and mechanisms.

Existing UK-funded studies at the time centred mainly on the general population, leaving a critical research gap around healthcare workers—particularly those from ethnic-minority backgrounds—whose higher exposure, occupational stress, and over-representation in frontline roles may elevate both risk and impact.

Although since 2022, the UK COVID-19 Inquiry has begun to consider long COVID, the specific experiences and needs of healthcare staff remained largely unaddressed, as highlighted by patient-led organisations.

We aimed to address these gaps through dedicated investigation, and to inform policy and practice, safeguard workforce sustainability, and protect the quality and resilience of patient care as health systems recover from the pandemic.

2. OVERALL METHODS

Key Points

- This project examined the prevalence, symptom patterns, and risk factors for long COVID among healthcare workers (HCWs) globally and in the UK.
- It assessed how socio-demographic, occupational and socio-cultural factors (including ethnicity, job role, migration status and deprivation) relate to long COVID in diverse HCW populations.
- It investigated the impacts of long COVID on HCWs' work and home lives, including the roles of support networks and organisational management.
- A mixed-methods, sequential explanatory design (Creswell et al., 2003) was used to integrate quantitative and qualitative evidence.
- Quantitative work comprised a systematic review and meta-analysis plus two UK cross-sectional analyses (UK-REACH early and later pandemic questionnaires).
- Qualitative interviews with HCWs, managers/HR, and support networks explored experiences, challenges, coping, and support needs.

2.1 Project aims and objectives

The overall aim was to examine the prevalence, symptomatology, and risk factors associated with long COVID among HCWs both globally and within the UK. This included exploring how socio-demographic and occupational factors influence diverse HCW populations, as well as investigating the personal experiences of HCWs living with long COVID. In addition, we aimed to assess the broader implications of long COVID on the healthcare workforce—considering the roles of support networks and organisational management—to better understand its impact on both their work and home lives.

To achieve those aims, our specific objectives were, to:

1. Conduct a systematic review and meta-analysis on the global prevalence of long COVID and its most common symptoms among HCWs to
   a) estimate the pooled prevalence,
   b) identify the most common symptoms of long COVID among HCWs who were infected with SARS-CoV-2 virus globally, and
   c) investigate any differences by geographical region and other factors.

2. Conduct cross-sectional analyses to estimate the prevalence of long COVID among UK HCWs and assess its association with demographic (age, sex, ethnicity), occupational (job roles), and socio-cultural factors (migration status, deprivation indices) using early pandemic data.

3. Conduct cross sectional analyses to investigate the prevalence and symptom profiles of long COVID among UK HCWs in a later phase of the pandemic, examining the impact of additional clinical (vaccination status, COVID-19 variant type), demographic, and occupational factors, and exploring ethnic variations in symptom groups and compare symptoms patters among HCWs with and without long COVID.

4. Conduct qualitative research to explore and understand the experiences, challenges, and support systems associated with long COVID among HCWs, their support networks, managers, and its impacts on the healthcare workforce in the UK. The specific objectives for each group of participants are:

   a **For HCWs:**
   To examine their lived experiences of long COVID, including its progression and persistence of symptoms; understand the impact on their mental and physical health, work, and home life; and explore the strategies, support systems, and resources that influence their coping and management of the condition.

   b **For HCWs' support networks (e.g., household members, neighbours, healthcare colleagues):**
   To understand how the HCWs' experiences of long COVID affect those around them, including their home dynamics, mental and physical wellbeing, work responsibilities, and collective coping strategies; and to explore the support provided within their immediate environment and broader workplace community.

   c **For healthcare managers and HR managers within the NHS:**
   To explore their perspectives and personal experiences in managing HCWs with long COVID, including the organisational challenges, available support mechanisms, and policies; and to identify the training and development needs that can enhance their capacity to support affected HCWs and maintain workforce wellbeing.

2.2 Methodological approach

A mixed-methods approach was used that consisted of four studies:

i A systematic review and meta-analysis to estimate the prevalence of long COVID among HCWs globally and identify symptoms of long COVID, and their clustering;

ii A cross-sectional study to establish the prevalence of long COVID among HCWs in the UK during the early phase of the pandemic and identify associated demographic, occupational, and socio-cultural factors using data from the UK-REACH baseline questionnaire (December 2020 to March 2021). It focused on

early pandemic data, capturing associations between long COVID prevalence and demographic factors such as age, sex, ethnicity, and job role, as well as broader socio-cultural and health-related factors like migration status, psychological health, and pre-existing comorbidities;

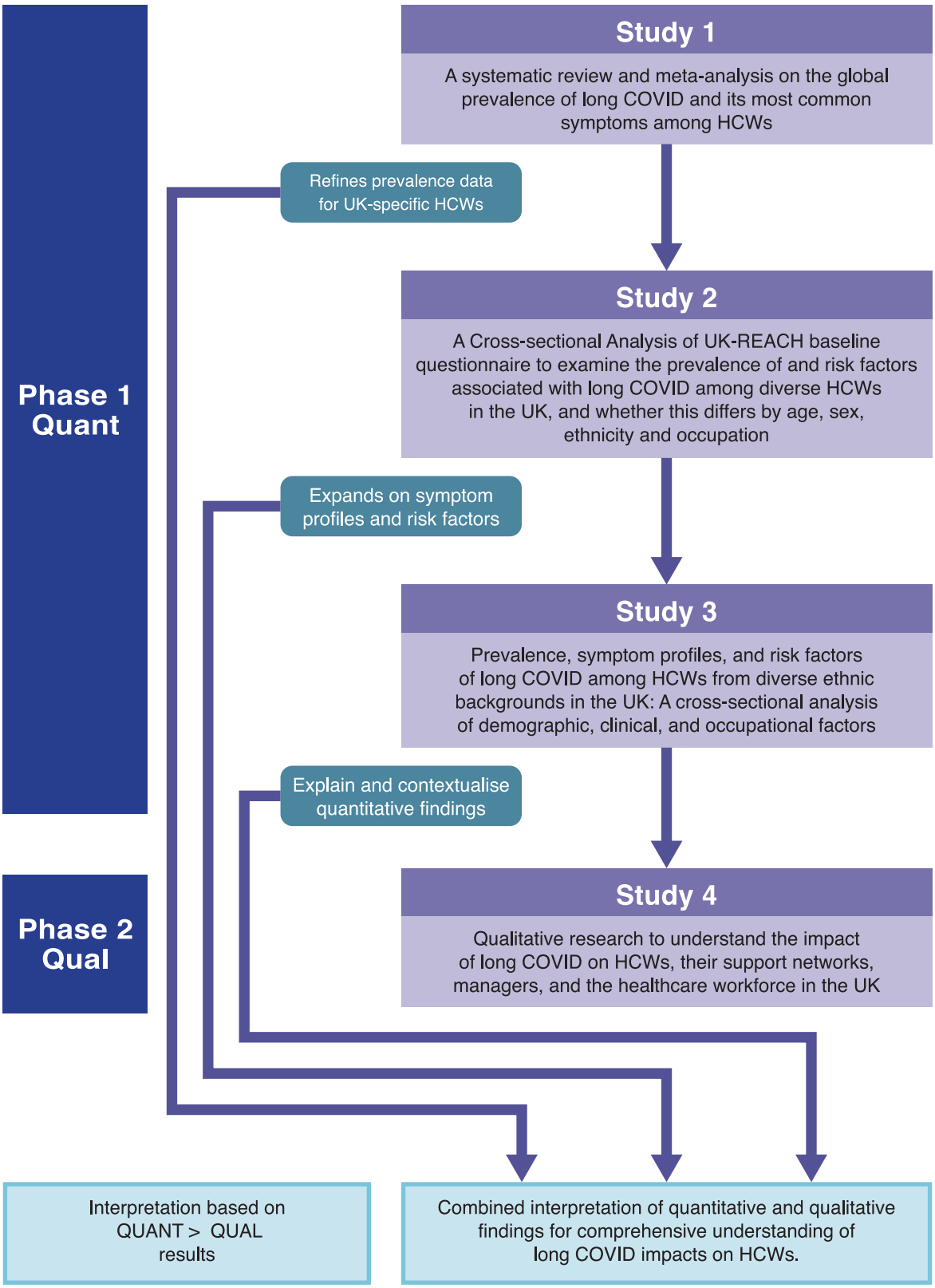
iii A cross-sectional study to investigate the prevalence and symptomatology of long COVID among HCWs in the UK at later stages of the pandemic, evaluating the impact of additional factors such as COVID-19 vaccination status, variant type, and healthcare roles. This study analysed data from the UK-REACH third and fourth questionnaires (October 2021–October 2022), integrating data to examine new dimensions of long COVID risk. Key factors include vaccination coverage, the severity of acute COVID-19, and the impact of COVID-19 variants. It also explores detailed symptom clusters and ethnic differences in symptom profiles; and

iv Qualitative research with HCWs, Human Resources (HR)/healthcare managers, their support network members to understand the short- and medium-term impacts of long COVID.

We specifically utilised the Sequential Explanatory Design as outlined by Creswell et al. (2003),[111] to gain a holistic understanding of the prevalence, symptoms, and diverse impacts of long COVID among HCWs in the UK (see **Figure 2.1**).

In the first phase (i.e., the quantitative component of Creswell et al.'s design), we collected and analysed quantitative data through a systematic review, meta-analysis, and cross-sectional analyses. These methods allowed for the identification of prevalence rates, symptom profiles, and odds ratios associated with long COVID across different demographics within HCWs both globally and in the UK. The second phase ((i.e., the qualitative component), involved qualitative interviews with HCWs, healthcare managers, and members of their support networks, which provided a deeper understanding into how long COVID influences HCWs' personal and work lives, expanded on why these

Figure 2.1. Sequential Explanatory Mixed Methods Design for Assessing Long COVID and its Impacts on Healthcare Workers, adapted from Creswell et, al., (2003).



2.3 An overview of UK-REACH study

UK-REACH (United Kingdom Research study into Ethnicity And COVID-19 outcomes in HCWs) is a prospective cohort study that began in November 2020 and examined how and why ethnicity affects COVID-19 outcomes and the impact of COVID-19 on HCWs. Its aim was to determine whether, and to what degree, there has been a disproportionate impact of the COVID-19 pandemic on ethnic minority HCWs. Details of the study's cohort profile, design, sampling, and measures included in their questionnaires can be found in the study protocol,[112] the cohort profile,[113] and the data dictionary (https://www.uk-reach.org/data-dictionary).

For further details about UK-REACH study, please read our first report: https://nhsrho.org/research/reach-out-caring-for-the-healthcare-workforce-post-covid-19/

2.4 Stakeholder engagement activity

We recruited six HCWs with long COVID from different occupational roles (both clinical and non-clinical) and ethnic backgrounds. This group, referred to as the Professional Expert Panel (PEP), attended biannual meetings in which they:

- Brought lived experience of long COVID alongside their healthcare roles (clinical and non-clinical) to inform the research.
- Provided input on survey development, including attending meetings to advise on survey questions before launch.
- Reviewed and provided feedback on qualitative interview guides.
- Contributed to research outputs, including involvement with the research team in writing commentaries on long COVID in healthcare workers.

2.5 Ethical approval

Studies conducted as part of this project received ethical approval from the Health Research Authority (Brighton and Sussex Research Ethics Committee; ethics reference: 20/HRA/4718).

3.GLOBAL PREVALENCE OF LONG COVID AND ITS MOST COMMON SYMPTOMS AMONG HEALTHCARE WORKERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Key Points

- Objectives: to estimate the pooled prevalence and identify the most common symptoms of long COVID among HCWs who were infected with SARS-CoV-2 virus globally, and investigate any differences by geographical region and other factors.
- Design: Systematic review and meta-analysis (PROSPERO CRD42022312781).
- Data sources: We searched MEDLINE, CINAHL, EMBASE, PsycINFO and the grey literature from 31 December 2019 until 18 February 2022.
- Eligibility criteria: We included studies reporting primary data on long COVID prevalence and symptoms in adult HCWs who had SARS-CoV-2 infection.
- Data extraction and synthesis: Methodological quality was assessed using the Joanna Briggs Institute checklist. Meta-analysis was performed for prevalence data of long COVID following SARS-CoV-2 infection.
- Results: Out of 5737 articles, 28 met the inclusion criteria, with a combined sample size of 6 481 HCWs. 15 articles scored equal to or above the median score for methodological quality. The pooled prevalence of long COVID among HCWs who had SARS-CoV-2 infection was 40% (95% CI: 29% to 51%, I2: 97.2%; 12 studies), with a mean follow-up period of 22 weeks. The most prevalent symptoms reported were fatigue (35%), neurologic symptoms (25%), loss/decrease of smell and/or taste (25%), myalgia (22%) and shortness of breath (19%).
- Conclusion: This review highlights the substantial burden of long COVID among HCWs worldwide. However, limitations in data quality and inconsistent definitions of long COVID impact the generalisability of these findings.
- Full published article: Al-Oraibi A, et al., (2025). Global prevalence of long COVID and its most common symptoms among healthcare workers: a systematic review and meta-analysis. BMJ Public Health.DOI: 10.1136/bmjph-2023-000269

3.1 Introduction

Despite the extensive research conducted on long COVID, critical knowledge gaps remain, particularly regarding the global burden of long COVID among HCWs. These gaps include inconsistent prevalence estimates and a lack of comparative analyses across geographical regions and other socio-demographic factors. Additionally, while HCWs represent a high-risk group due to occupational exposure, a systematic examination of the burden of long COVID in this population is limited, especially on a global scale.[115,116] Since HCWs are likely to have greater exposure to COVID-19 than the general population, and therefore have a higher risk of infection and subsequently a higher risk of long COVID, it is important to look into this further. Moreover, there may be a higher degree of stress due to

working throughout a pandemic which may exacerbate risk factors following acute infection for the development of long COVID.[67]

To address these gaps, we conducted a systematic review and meta-analysis in which we estimated the pooled prevalence of long COVID among HCWs infected with SARS-CoV-2 and identified the most commonly reported symptoms.

3.2 Methods

We registered the protocol PROSPERO, under registration number: CRD42022312781[117] and it has been published.[118]

3.2.1 Eligibility criteria

Following NICE definition of ongoing symptomatic COVID-19[119] we defined long COVID as persistent/prolonged (constant, fluctuating or relapsing) symptoms and/or functional disability following SARS-CoV-2 infection for ≥ 4 weeks from onset of symptoms or from time of diagnosis, among adult (≥ 16 years old) HCWs (clinical and non-clinical staff), worldwide of those who work in a healthcare or social care settings where SARS-CoV-2 infection was self-reported, clinically diagnosed, and/or diagnosed through a laboratory test (see **Table 3.1**).
As definitions of long COVID have varied and changed over time,[47,120] we also included any study that defined/reported the condition as 'long COVID' or persistent symptoms following SARS-CoV-2 infection in addition to studies reporting symptoms that align with my definition (even if studies did not define it as 'long COVID'). This is so wedo not inadvertently miss studies.

In this review, HCWs are defined broadly in line with the WHO's categorisation as all individuals engaged in actions whose primary intent is to enhance health outcomes.[121] This includes, but is not limited to: medical, nursing, and midwifery professionals; allied health professionals (AHPs; such as physiotherapists, occupational therapists, and pharmacists); support staff (including healthcare assistants, laundry and cleaning staff, and those involved in facility maintenance and food services); administrative and office personnel within healthcare settings; and social workers (when their role directly relates to health care provision and patient support). This inclusive definition allows for a comprehensive analysis of global HCWs taking into account the variety in defining different healthcare professions worldwide, recognising the vital contributions of both patient-facing and support roles. This wide definition aligns with the definition from the International Labour Organization.[122]

Types of studies

We included all published peer-reviewed papers reporting any primary data on the prevalence of long COVID among HCWs, such as mixed-methods studies, observational studies (including cross-sectional, retrospective, and prospective cohort studies), and case-control studies. Additionally, we included pre-print articles and reports that provided primary quantitative data on the prevalence and/or symptoms of long COVID following confirmed, probable or suspected

SARS-CoV-2 infection, as also searching the grey literature provides a more comprehensive view of the available evidence.123

We excluded studies such as case reports, case series, and qualitative study designs as these would not report the prevalence data required for this review.

Search strategy

3.2.2 Databases searched

We searched the following databases from 31 Dec 2019 until 18 Feb 2022: MEDLINE (via Ovid), CINAHL (via EBSCO), EMBASE (via Ovid), and PsycINFO (via EBSCO), in addition to searching the grey literature using MedRxiv (pre-print server), and OpenGrey (grey literature database) with no language restrictions.

3.2.3 Statistical analysis

We carried out meta-analysis of the data using Stata 16 (Stata Corp LLC, Texas, USA).[124] We used random-effects models to account for the variability both within and between studies.125 The proportion or percentage of individuals in each study sample with each long COVID symptom was pooled and 95% CIs were calculated to produce the estimated proportion across studies. Where a study reported the prevalence as a percentage (% prevalence), the number of cases (n) was calculated using the following formula:

$$\text{Number of cases (n)} = \frac{(\%\ \text{Prevalence}^*\ \text{Sample size (N)})}{100}$$

We grouped symptoms according to different organ systems based on how they were grouped in existing literature.[3,42,126] This included: (i) cardiac symptoms or diagnoses (e.g., pericarditis, myocardial injury, tachycardia, syncopal attacks, chest pain), (ii) fatigue, (iii) shortness of breath, (iv) neurologic symptoms (e.g., headaches, dizziness, migraines, memory loss, insomnia, or nightmares), (v) loss/decrease of sense of smell and/or taste, (vi) cough, (vii) alopecia, (viii) myalgia (including joint pain), (ix) depression, (x) anxiety, and (xi) asthenia.

We assessed heterogeneity using the I^2 statistic and explored this by conducting sub-group analyses where appropriate to assess the impact of individual study characteristics on the prevalence estimates.[127]

We assessed publication bias using Egger's test and DOI plot for the studies included in the pooled prevalence meta-analysis.[36]

To assess the impact of the methodological quality on the pooled prevalence of long COVID we conducted a sensitivity analysis by removing included studies categorised as poor quality and/or studies that were not peer-reviewed (i.e., pre-prints). Furthermore, we conducted a sensitivity analysis on the most common symptom reported within each included study, and another sensitivity analysis in which we removed studies with self-reported data.[128]

3.3 Results

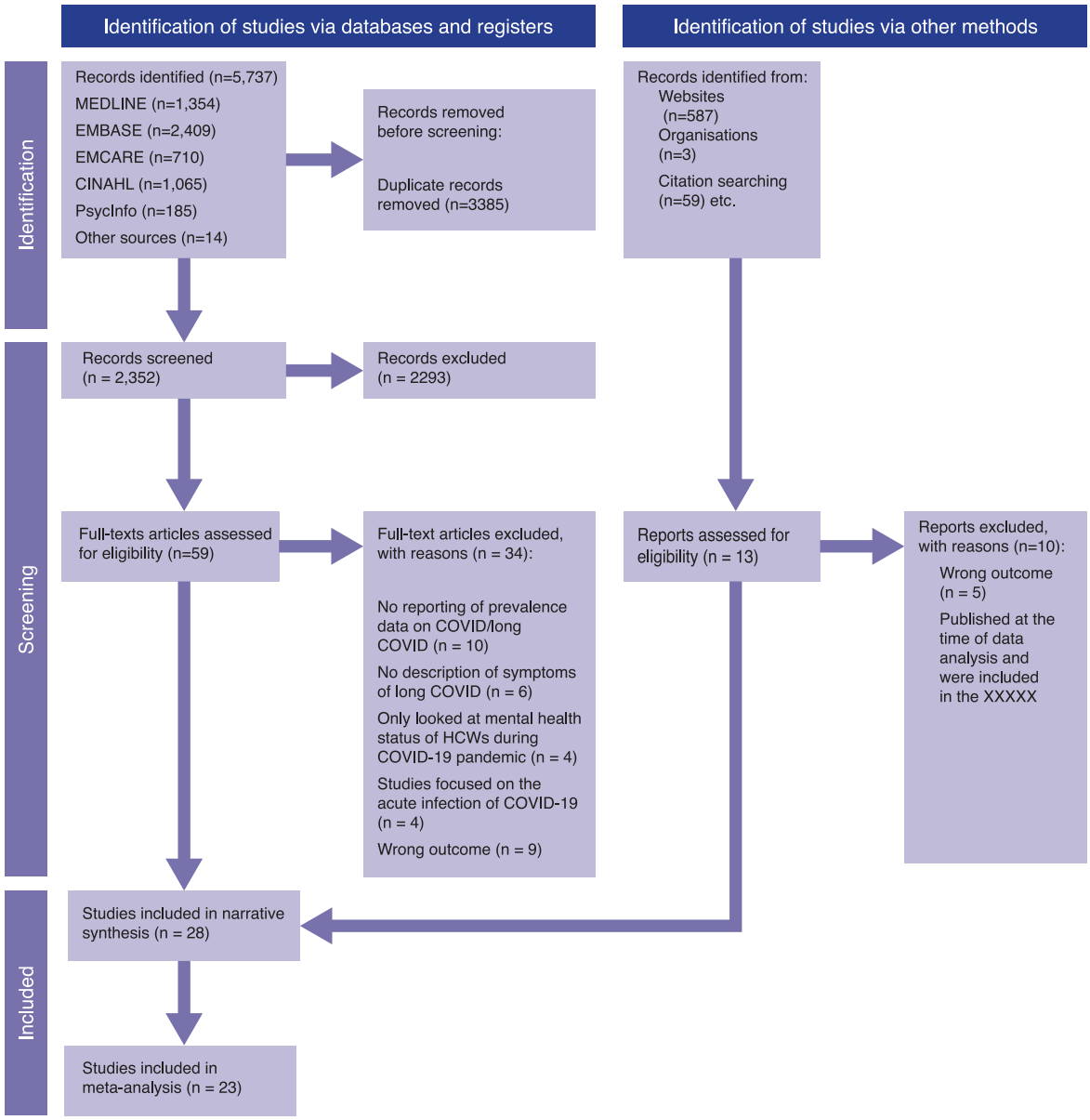
3.3.1 Study selection

We identified 5,737 articles as shown in Figure 3.1. 3,385 were duplicates and were excluded. Of the 2,352 remaining articles I excluded a further 2,293 after screening titles and abstracts. We excluded 34 further articles after full text review.

We found an additional 649 records from other sources, including grey literature and searching citations. We excluded 636 after screening titles and abstracts. After full-text screening of the remaining 13 I excluded ten. The remaining three articles met the inclusion criteria and were included in the review in addition to the 25 articles obtained from the database searches, giving a total of 28 articles included in the review.

Of the 28 articles included in this review, 23 were included in the meta-analysis.[108,115,129–148] Five articles [149–152] were not included in the meta-analysis because they reported aggregated data on the prevalence of long COVID in their cohort (the prevalence of long COVID among HCWs was not obtainable), making it difficult to identify the number of cases for each symptom of long COVID that we identified. These five articles were included in the narrative synthesis only.[149–152]

Figure 3.1. PRISMA flow diagram



3.3.2 Study characteristics

See **Table 3.2** for the summary of characteristics of the 28 articles that met the inclusion criteria.

Study design

Thirteen of the 28 articles used a cross-sectional survey study design,[110,132,135–138,140–142,145,147,148,151] and [14] were cohort studies.[116,129–131,133,134,139,143,144,146,150,152,153] Of the cohort studies, eight were prospective,[116,129,131,133,134,139,146,152] five were retrospective, [108,130,144,150,153] and one adopted a nested cohort study design.[143] One included article was a short communication.[149]

Table 3.2.

Author and year of publication	Study design	Country	Setting/ context	Time period	Sample size (N)	Female N (%)	Mean age (SD)	Population	Main outcomes/ measures	Follow-up period	COVID-19 infection confirmed by	Long COVID criteria	Mention of ethnicity	Critical Appraisal Score (%)
Fijałkowska, Jadwiga, et al. (2021)	Short communication	Poland	Hospital	Dec 2020 - Apr 2021	89	69 (77)	42 (10)	HCWs who recovered from non-severe COVID-19	Myocardial injury	4 months	PCR			56
Navarro-Font, Xavier, et al. (2021)	Retrospective cohort	Spain	Hospital	Sep 2020 - Oct 2020	119	-78.3	40.6 (11.6)	HCWs from CUN	Severity of COVID-19 and chronic disease sequelae	4-6 months	PCR	NA		89
Glück, Vivian, et al. (2021)	Prospective cohort	Germany	Hospital	Apr 2020 - Dec 2020	123	75 (62)	Median (Females=37, Males=40)	Infected HCWs from a network of 6 hospitals in the southeast region of Germany	Antibody status	30 week (7.5 months)	PCR	NA		78
Tawfik, Heba Mohamed, et al. (2021)	Retrospective cohort	Egypt	Ain-Shams University, the MOH and population hospitals	NA	120	70 (58%)	33.7 (7.3)	HCWs (i.e., doctors, nurses, dentists, pharmacists)	Symptoms of long COVID	1-3 months	PCR	Persistence symptoms at 3 months		44
Havervall, Sebastian, et al. (2021)	Prospective cohort	Sweden	Danderyd Hospital	Apr 2020 - May 2020	323	268 (83%)	Median (IQR) 43 (33-52)	HCWs who consented to fill out the questionnaires and do blood sampling every 4 months	Sheehan Disability Scale and symptoms	8 months	NA	Persistent symptoms at 4 months		78
Rao, Shwethapriya, et al. (2021)	Cross-sectional	India	Web-based survey	Jan 2021 - Mar 2021	163	-59	NA	HCWs (i.e., doctors, nurses, allied health professionals)	Post-COVID-19 syndromes	3 months	NA	Persistent symptoms following recovery from COVID-19 (duration not mentioned)		44
Strahm, Carol, et al. (2022)	Prospective cohort	Switzerland	Hospital	Jul 2020 - Jan 2021	556	453 (81)	Median (IQR) 38.9 (16.8-63.5)	HCWs (i.e., nurses, physicians, others) from 23 healthcare institutions in northern and eastern Switzerland	Symptom questionnaire associated with long COVID and 4 psychometric scores	Different ranges up to 24 weeks	PCR & antibody	Persistence of symptoms 4 weeks after acute infection	Caucasian 775/784 (99%), Other 9/784 (1.1%)	78

Author and year of publication	Study design	Country	Setting/ context	Time period	Sample size (N)	Female N (%)	Mean age (SD)	Population	Main outcomes/ measures	Follow-up period	COVID-19 infection confirmed by	Long COVID criteria	Mention of ethnicity	Critical Appraisal Score (%)
Eiros, Rocío, et al. (2021)	Cross-sectional	Spain	Hospital	May 2020 - Jun 2020	139	100 (72)	Median (IQR) 52 (41-57)	HCWs from University Hospital of Salamanca	CMR images and immunophenotypic analysis of peripheral blood sample	10.4 weeks	PCR & antibody	NA		78
Liao, Tingting, et al. (2021)	Prospective cohort	China	Hospital	Mar 2021 - Apr 2021	210	171 (81)	Median (IQR) 38 (33-48)	HCWs working in an outpatient clinic of the Wuhan Union Hospital.	Six min walk test, physical and psychiatric measures for PTSD	1 year	NA	NA		89
Vimercati, Luigi, et al. (2021)	Retrospective cohort	Italy	Hospital	Mar 2020 - Mar 2021	352	NA	45.4 (13.2)	HCWs (i.e., nusres, doctors, HCA) working in University Hospital of Bari	Long COVID 34 days off work or more	1 year	PCR	Being off work for >34 days		33
Sultana, Sarmin, et al. (2021)	Cross-sectional	Bangladesh	Foundation	Apr 2020 - Jul 2020	186	63 (33.9)	34.8 (9.9)	Bangladesh medical doctors in Bangladesh Doctors Foundation	Long COVID symptoms	2 months	PCR	At least one of long COVID symptoms persisting > 60 days		22
Kisiel, Marta, et al. (2021)	Prospective cohort	Sweden	Hospital	Mar 2020 - Aug 2020	433	335 (77)	42 (12)	Symptomatic employees of The Department of Infectious Disease at the Uppsala University who did not receive inpatient care	Days of sick leave	8-12 months	PCR	Sick leave of >3 weeks		78
Martinez, Aurelien Emmanuel , et al. (2021)	Retrospective cohort	Switzerland	Hospital	Apr 2021- Jun 2021	260	196 (75.4)	Median (IQR) 37 (28-49)	HCWs at University Hospital Basel who replied to the online questionnaire following their COVID-19 infection	Persistent COVID-19 symptoms	3-12 months	Self-reported	Persistent symptoms for ≥ 3 months		78
Abu-Hammad, Osama, et al. (2021)	Cross-sectional	Saudi Arabia	Dental hospital	Mar 2021 - Aug 2021	62	30 (17.3)	NA	Clinical dental students (4th, 5th, 6th years, and interns) and faculty currently practicing at the hospital	Types of long-term health and socioeconomic complications among infected personnel	NA	NA	NA		56
Gaber, T A-Z K, et al. (2021)	Cross-sectional	UK	Web-based survey	Jul 2020 - Aug 2020	138	127 (92)	NA	HCWs who work in Wrightington, Wigan and Leigh NHS Teaching Trust	Post-COVID-19 symptoms with post-viral fatigue	4 months	Antibody	NA		-
Xiong, Li-Juan, et al. (2021)	Case-control	China	Web-based survey	Jul 2020 - NA	291	236 (81.1)	37.3 (8.9)	HCWs who were recovered at the time of the study.	Risk of PTSD	6 months	PCR	NA		67

Author and year of publication	Study design	Country	Setting/ context	Time period	Sample size (N)	Female N (%)	Mean age (SD)	Population	Main outcomes/ measures	Follow-up period	COVID-19 infection confirmed by	Long COVID criteria	Mention of ethnicity	Critical Appraisal Score (%)
Sawant, N, et al. (2021)	Cross-sectional	India	Web-based survey	Oct 2020 - end of Oct 2020	79	33 (41.8)	26.4 (3.3)	Resident doctors and interns from the hospital database of COVID affected healthcare personnel who were completely recovered.	Presence of anxiety and depressive symptoms	4 months		NA		44
Dudine, L, et al. (2021)	Cross-sectional	Italy	Community	Jun 2020 - Sep 2020	104	71 (68.3)	42 (11)	HCW of the Trieste area in Northern Italy	The association between olfactory and gustatory dysfunctions and a state of distress	NA	NA	NA		67
Nielsen, KJ, et al. (2021)	Prospective cohort	Denmark	All hospitals in the Central Denmark region	Apr 2020 - Jun 2020	210	177 (84.3)	IQR= (40-49)	HCWs (i.e., nursing staff, medical doctors, biomedical laboratory scientists & medical secretaries)with COVID-19 during data collection period	Symptom profile	90 days (three time periods (0–30, 31–60, and 61–90 days))	PCR	60-90 days		89
Kinge, Constance Wose, et al. (2022)	Cross-sectional	South Africa	Web-based survey	Feb 2021 - Apr 2021	62	47 (76)	Median IQR 33.5 (30–44)	NGO workers in one of seven provinces who had COVID-19 and are fighting HIV & AIDS	Long COVID prevalence among HIV & AIDS NGO workers	3 months	PCR	Post-acute	African, Caucasian & coloured	89
Bozan, Öner, et al. (2021)	Cross-sectional	Turkey	Web-based survey	1 Mar 2021 - 15 Mar 2021	248	130 (52.4)	32.8 (8.0)	HCWs who were infected with COVID-19 and recovered at least 30 days before data collection.	differences or changes in the quality of sleep of patients recovering from COVID-19 infection	NA	PCR	NA		44

Author and year of publication	Study design	Country	Setting/ context	Time period	Sample size (N)	Female N (%)	Mean age (SD)	Population	Main outcomes/ measures	Follow-up period	COVID-19 infection confirmed by	Long COVID criteria	Mention of ethnicity	Critical Appraisal Score (%)
Bussière, Nicholas, et al. (2021)	Cross-sectional	Canada	Web-based survey	Aug 2020 - Oct 2020	704	111 (15.8)	42 (11.7)	HCWs from Quebec who took part in a study from the Institut National de Santé Publique du Québec and agreed to be re-contacted for further research.	Differences in reported chemosensory self-assessment of olfactory, gustatory, and trigeminal functions across time points and Chemosensory Perception Test scores	3-7 months	PCR	This study reports chemosensory dysfunction 3-7 months following SARS-CoV-2 infection in RT-PCR confirmed healthcare workers. The questionnaire was completed on average 4.8 (SD: 0.8, range 3-7) months after symptom onset.		56
Uvais, Nalakath A., et al. (2021)	Cross-sectional	India	Hopsital	NA	107	-63.6	27.5	HCWs from a tertiary care hospital in South India	Insomnia and its severity	NA	Self-reported	NA		56
Mattioli, Flavia, et al. (2021)	Prospective cohort	Italy	Hospital	NA	120	-70	47.86	HCWs who worked at The Unit of Occupational Health of the general University Hospital of Brescia who underwent a targeted clinical diagnostic assessment including, a neurological exam and a detailed neuropsychological evaluation	Health status after COVID-19	4 months	PCR	4 month following positive RT-PCR		78

Author and year of publication	Study design	Country	Setting/ context	Time period	Sample size (N)	Female N (%)	Mean age (SD)	Population	Main outcomes/ measures	Follow-up period	COVID-19 infection confirmed by	Long COVID criteria	Mention of ethnicity	Critical Appraisal Score (%)
Tempany, M, et al. (2021)	Cross-sectional	Ireland	Hospital	Jun 2020 - Nov 2020	217	174 (80.2)	NA	HCWs who presented for SARS-CoV-2 antibody testing at least 12 weeks since confirmed infection or onset of symptoms	Degree of recovery & nature of persistent symptoms	At least 12 weeks	PCR & antibody	Persistent symptoms for 12 weeks		78
Grey Literature (pre-prints)														
Dennis, A, et al. (Pre-print)	Prospective cohort	UK	Two non-acute settings	Apr 2020 - Aug 2021	172	142 (82.5)	43.96 (10.9)	HCWs in Oxford and London with evidence of organ impairment following recovery from acute COVID-19	Prevalence of single and multi-organ impairment	At 6 and 12 months	PCR & antibody		White 145, mixed 6, south Asian 15 , Black 6	78
Gruber, R, et al. (Pre-print)	Retrospective cohort	Germany	Medical centers	Jun 2021 - Oct 2021	221	158 (71.5)	39.8 (12.5)	HCWs (nursing staff, medicals taff, administration, cleaning staff and others) with severe acute infection from three medical centers in Cologne, Germany.	Frequency and duration of long-term COVID-19 symptoms	491 days with six-weeks intervals	PCR & antibody		NA	78
Mohr, N M, et al (Pre-print)	Nested cohort	USA	Academic medical centers	Dec 2020 - Aug 2021	419	352 (84)	38.4 (10.6)	HCWs (non-clinical, physicians, nursing professionals, housekeeping) who were working on-site in 12 U.S states	Presence of symptoms 6 weeks after onset of COVID-19 illness and days to return to work after COVID-19 illness	Six weeks	PCR & antibody		White non-hispanic 303(72.3), Black non-hispanic 47 (11.2), Hispanic or Latino 41 (9.8), Other non-hispanic 28 (6.7)	89

Study participants

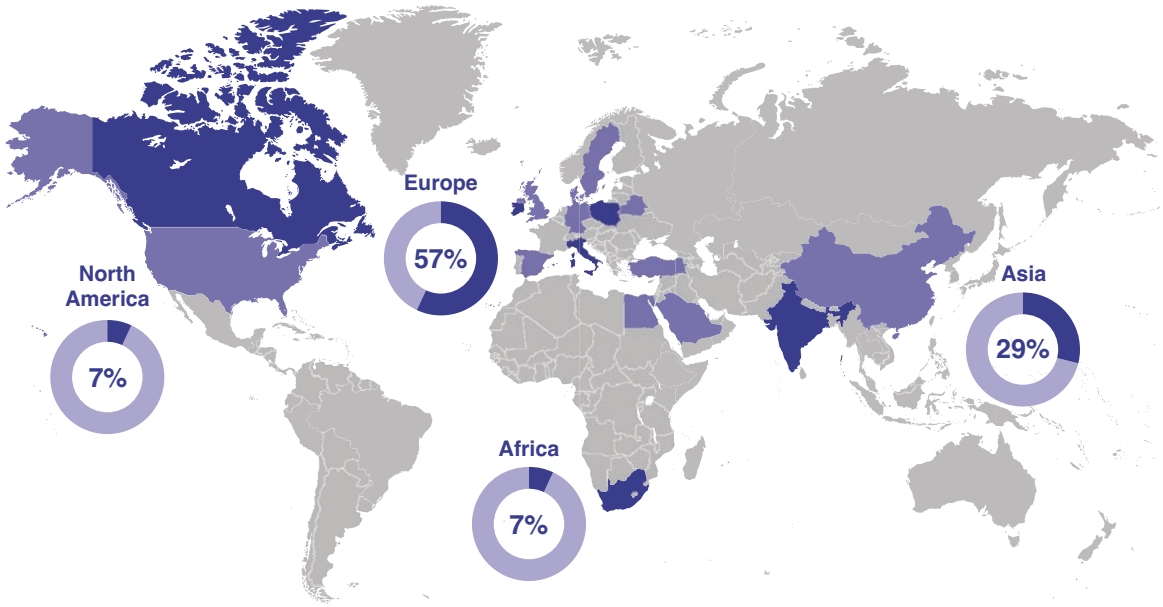
A total of 6,481 HCWs who have had SARS-CoV-2 infection from 28 articles were included in this review. Sample sizes of HCWs ranged widely, from 62 HCWs [148] to 704 HCWs.[140]

The mean age of the participants was reported in 17 articles.[116,130,135–138,140,141,143–146,149–153], with the mean age ranging from 26[137] to 45 years.[150] Eight articles reported median age ranging from 33.5[148] to 52 years [147]or IQR or both. [108,129,131,133,134,139,147,148]

Study settings

Most studies (n=16, 57%) were from Europe, 29% (n=8) were from Asia, 7% (n=2) were from Africa, and the remaining two (7%) were from North America (as shown in **Figure 3.2**).

Figure 3.2. Country/region of origin of included studies



Confirmation of COVID-19 infection and follow-up period

22 of the 28 included articles reported the method by which infection was confirmed. Thirteen of these included patients who had a positive PCR test performed on either nasopharyngeal or oropharyngeal swabs, [116,129,130,135,139,140,144,148–150] five studies included patients who had a positive SARS-CoV-2 PCR test and/or anti-nucleocapsid SARS-CoV-2-immunoglobulin G (IgG) antibodies test,[133,142,143,147,153] and one study included patients who had a positive serology test (i.e., antibody test).[110] The remaining three studies had patients who were diagnosed with COVID-19 based on self-reporting.[108,141,146]

Follow-up time was reported in 24 of the 28 included studies and ranged from 42 days (6 weeks) to 491 days (~1 year and 3 months).

Reporting on ethnicity

Only four of the 28 included studies reported on ethnicity.[133,143,146,148] Two were peer-reviewed,[133,148] one reported three categories (African, Caucasian, and Coloured),[148] and the other classified ethnicity data into two categories (Caucasian, and Other).[133] Two articles were pre-prints that reported more specific categories of ethnicity.[143,146]

3.4 The methodological quality of individual studies and publication bias

Table 3.3 presents the scoring for methodological quality of included studies. The median score for the number of 'Yes' in each included study is 78%. 15 articles scored equal or above the median score with scores ranging from 78-89%. Two studies were of poor quality.[135,150]

The DOI plot indicated a significant asymmetry in the data (number of included studies = 12), suggesting the presence of publication bias (Egger's test, P=0.011, LFK index = 3.63). These 12 studies were included in the DOI plot as they formed the basis of the pooled prevalence meta-analysis.

Table 3.3

Author and year of publication	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	(%) Yes
Fijałkowska, Jadwiga, et al. (2021)	N	U	N	Y	Y	Y	Y	Y	U	56
Navarro-Font, Xavier, et al. (2021)	Y	Y	N	Y	Y	Y	Y	Y	Y	89
Glück, Vivian, et al. (2021)	Y	Y	Y	Y	N	Y	Y	Y	U	78
Tawfik, Heba Mohamed, et al. (2021)	Y	Y	Y	N	N	Y	N	N	N	44
Havervall, Sebastian, et al. (2021)	Y	Y	N	Y	N	Y	Y	Y	Y	78
Rao, Shwethapriya, et al. (2021)	Y	Y	N	Y	N	N	N	N	Y	44
Strahm, Carol, et al. (2022)	Y	Y	Y	Y	N	Y	Y	Y	N	78
Eiros, Rocío, et al. (2021)	Y	Y	N	Y	Y	Y	Y	Y	N	78
Liao, Tingting, et al. (2021)	Y	Y	N	Y	Y	Y	Y	Y	Y	89
Vimercati, Luigi, et al. (2021)	Y	N	Y	Y	N	N	N	N	N	33
Sultana, Sarmin, et al. (2021)	N	N	Y	Y	N	N	N	N	N	22
Kisiel, Marta, et al. (2021)	Y	Y	Y	Y	Y	N	N	Y	Y	78
Martinez, Aurelien Emmanuel , et al. (2021)	Y	Y	N	Y	Y	Y	Y	N	Y	78
Abu-Hammad, Osama, et al. (2021)	Y	Y	Y	N	U	N	Y	U	Y	56
Gaber, T A-Z K, et al. (2021)	Correspondence letter									
Xiong, Li-Juan, et al. (2021)	Y	Y	N	Y	Y	Y	NA	Y	N	67
Sawant, N, et al. (2021)	Y	Y	N	Y	N	Y	N	N	N	44

Dudine, L, et al. (2021)	Y	U	Y	Y	Y	Y	Y	N	U	67
Nielsen, KJ, et al. (2021)	Y	Y	Y	Y	Y	Y	Y	Y	U	89
Kinge, Constance Wose, et al. (2022)	Y	Y	Y	Y	Y	Y	Y	Y	U	89
Bozan, Öner, et al. (2021)	Y	Y	U	N	Y	U	U	Y	U	44
Bussière, Nicholas, et al. (2021)	Y	Y	Y	N	Y	N	U	N	Y	56
Uvais, Nalakath A., et al. (2021)	Y	U	Y	Y	N	Y	Y	N	N	56
Mattioli, Flavia, et al. (2021)	Y	Y	Y	N	Y	Y	U	Y	Y	78
Tempany, M, et al. (2021)	N	Y	Y	N	Y	Y	Y	Y	Y	78
Grey Literature (Pre-prints)										
Dennis, A, et al. (Pre-print)	Y	Y	Y	Y	Y	Y	U	N	Y	78
Gruber, R, et al.(Pre-print)	Y	Y	Y	Y	Y	N	Y	N	Y	78
Mohr, N M,et al (Pre-print)	Y	Y	Y	Y	Y	Y	U	Y	Y	89
Total (%) Yes	86	79	61	75	61	68	54	54	46	
Y: Yes; **U**: Unclear; **N**: No; **NA**: Not Available										
JBI critical appraisal questions:										
Q1. Was the sample frame appropriate to address the target population?										
Q2. Were study participants sampled in an appropriate way										
Q3. Was the sample size adequate?										
Q4. Were the study subjects and the setting described in detail?										
Q5. Was the data analysis conducted with sufficient coverage of the identified sample?										
Q6. Were valid methods used for the identification of the condition?										
Q7. Was the condition measured in a standard, reliable way for all participants?										
Q8. Was there appropriate statistical analysis?										
Q9. Was the response rate adequate, and if not, was the low response rate managed appropriately?										

3.5 Findings of individual studies and synthesis of results

3.5.1 Prevalence findings

The pooled prevalence of long COVID amongst HCWs who had been infected with SARS-CoV-2 virus was 40% (95% CI: 29%–51%, I2: 97.2%; 12 studies) with a mean follow-up period of 22.2 weeks for studies that stated the follow-up time, as shown in **Figure 3.3.**

There was no statistically significant difference in the prevalence by region, although the pooled prevalence was slightly higher in Asia (43%; 95% CI: 14%–72%; 3 studies) compared to Europe (41%; 95% CI: 27%–55%; 8 studies) - see **Figure 3.4.**

Figure 3.3. Forest plot showing point estimates with 95% confidence intervals for the pooled prevalence of long COVID symptoms among HCWs who were infected with SARS-CoV-2 virus

Figure 3.4 Forest plot showing point estimates with 95% confidence intervals for prevalence of long COVID symptoms among HCWs who were infected with SARS-CoV-2 virus– Sub-group analysis by region-

Figure 3.5 shows the most common symptoms of long COVID. The five most prevalent symptoms reported were fatigue (35%; 95% CI 15%–56%; 14 studies), neurologic symptoms (25%; 95% CI 15%–34%; 16 studies), loss/decrease of sense of smell and/or taste (25%; 95% CI 15%–35%; 17 studies), myalgia (22%; 95% CI 12 %–32%; 12 studies), and shortness of breath (19%; 95% CI 3%–36%; 13 studies).

A summary of the prevalence estimates of the meta-analyses for the 11 most common symptoms of long COVID among HCWS infected with SARS-CoV-2 virus is presented in **Table 3.4.** Forest plots of the remaining 6 symptoms are also presented in **Figure 3.6.**

Figure 3.5. The most common symptoms of long COVID among HCWs

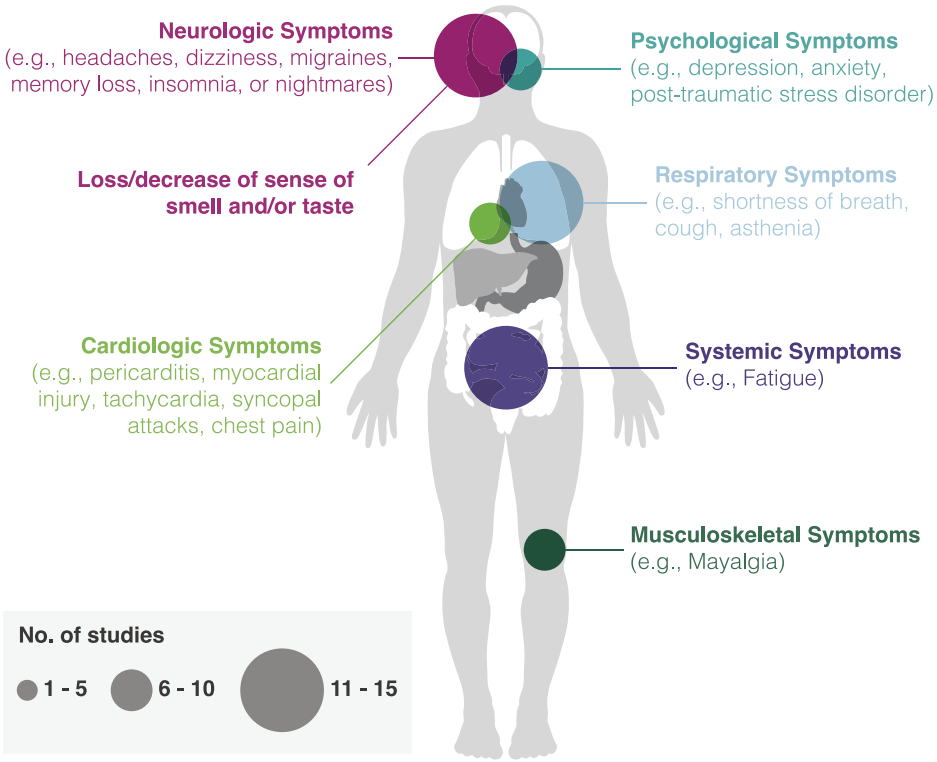


Figure 3.6. Forest plot showing point estimates with 95% confidence intervals for prevalence of the five most common long COVID symptoms among HCWs who were infected with SARS-CoV-2 virus

Table 3.4. A Summary of the Prevalence for the most common symptoms of long COVID

Type of long COVID symptom	Number of included studies	Pooled prevalence estimate (95% CIs)	I^2 Statistic
Fatigue	14	35% (15 – 56)	99.6%
Neurologic	16	25% (15 – 34)	98.6%
Loss/decrease of sense of smell and/or taste	17	25% (15 – 35)	99.1%
Myalgia	12	22% (12 – 32)	99.4%
Shortness of breath	13	19% (3 – 36)	99.8%
Depression	5	18% (7 – 29)	94.6%
Cardiac	8	17% (10 – 24)	98.1%
Asthenia	3	15% (3 – 27)	91.8%
Anxiety	6	9% (4 – 15)	91.9%
Alopecia	8	7% (3 – 11)	93.7%
Cough	6	5% (3 – 8)	82.1%

The estimated pooled prevalence was 17% lower in studies with follow-up period ≥12 months (estimated pooled prevalence: 26%; 95% CI: 7%–46%: 3 studies) compared to those with <12 months follow-up (estimated pooled prevalence: 43%; 95% CI: 32%–54%: 7 studies); see **Figure 3.7.** This difference was statistically significant ($p \leq 0.001$).

Sensitivity analyses of studies that were rated as acceptable quality and peer-reviewed showed no changes in the estimated prevalence **(Supplementary material 1).** Furthermore, sensitivity analyses of the pooled prevalence of the most common symptoms, and of studies in which data was not self-reported, showed no differences compared to overall pooled prevalence of long COVID **(Supplementary material 2).**

Figure 3.7. Forest plot showing point estimates with 95% confidence intervals for prevalence of long COVID symptoms among HCWs who were infected with SARS-CoV-2 virus– Sub-group analysis by follow-up period-

*Note: two studies were removed from this analysis as they did not state the follow-up period.

3.6 Summary

Overall, our meta-analyses showed a high prevalence of long COVID among HCWs who had COVID-19 (40%) within a follow-up range from 42 to 491 days. The prevalence was significantly lower (26%) in studies with follow-up period ≥12 months compared with those with <12 months follow-up (43%). The most commonly reported symptoms included fatigue (35%), neurologic symptoms (25%), loss/decrease of sense of smell and/or taste (25%), myalgia (22%), and shortness of breath (19%). There was no statistically significant difference in prevalence by region and there were not enough studies to explore differences by ethnicity (n=4).

In conclusion, this review provides an insight into the burden of long COVID among HCWs who had SARS-CoV-2 infection. Given the relatively high prevalence (40%), healthcare services and policy need to prioritise long COVID care among HCWs. To ensure consistent prevalence estimates of long COVID, it is crucial to develop standardised definitions and diagnostic criteria that can be uniformly applied across studies.

4.PREVALENCE OF AND FACTORS ASSOCIATED WITH LONG COVID AMONG DIVERSE HCWS IN THE UK: A CROSS-SECTIONAL ANALYSIS

Key Points

- Objectives: to assess the prevalence of UK healthcare workers (HCWs) who reported symptoms of COVID-19 lasting for longer than 5 weeks and examine associated factors with experiencing long COVID in an ethnically diverse cohort.
- Design: a cross-sectional study using data from UK-REACH study cohort.
- Setting Data were collected electronically between December 2020 and March 2021.
- Participants: individuals aged 16 years or older, residing in the UK, and working as HCWs or ancillary workers in a healthcare setting and/or registered with one of the seven major UK healthcare professional regulators.
- Primary and secondary outcome measures: the main outcome was long COVID (symptoms>5 weeks). The primary exposure of interest was self-reported ethnicity. We employed univariable and multivariable logistic regression to identify associations. We adjusted for demographic information, health status and existing long-term conditions in our multivariate analysis.
- Results: in our analysis of 11 513 HCWs, we found that 2331 (20.25%) reported COVID-19, of whom 525 (22.52%) experienced long COVID. There were no significant differences in risk of long COVID by ethnic group. In terms of other demographic characteristics, the majority of those experiencing long COVID were female (80.0%) and were slightly older than those who did not experience long COVID (median age 46 (IQR 36–54)). In multivariable analyses of those who reported having had COVID-19, HCWs in nursing/midwifery roles (adjusted OR (aOR) 1.76, 95% CI 1.26 to 2.46; p=0.001) and allied health professions (aOR 1.42, 95% CI 1.05 to 1.93; p=0.023) had higher odds of experiencing long COVID compared with those in medical roles. Other factors significantly associated with long COVID included self-reported psychological conditions (eg, depression and anxiety) and respiratory conditions (eg, asthma).
- Conclusions: Further research and collaborative efforts are urgently needed to address these factors effectively, develop targeted interventions and understand the temporal and longitudinal dynamics of the condition.
- Full published article: Al-Oraibi A, et al., (2024). Prevalence of and factors associated with long COVID among diverse healthcare workers in the UK: a cross-sectional analysis of a nationwide study (UK-REACH). BMJ Open. DOI: 10.1136/bmjopen-2024-086578

4.1 Introduction

The ethnic diversity within the HCW population in the UK, which includes a substantial representation of ethnic minority groups, underscores the importance of research on potential disparities in long COVID prevalence and its risk factors.

This is particularly relevant as ethnicity, socioeconomic status, and cultural perceptions of illness may influence the reporting and management of long COVID symptoms, raising concerns about healthcare equity within the workforce.[17] [91,154] In addition, the economic burden on healthcare systems like the NHS is substantial due to increased healthcare utilisation and long-term management of these patients.[155] Although various rehabilitation and support services are being established for long COVID patients, their effectiveness remains an area of active research. From a patient perspective, HCWs—who are often both caregivers and patients themselves—offer unique insights into living with long COVID, making them a critical group for focused research.[156]

Researchers frequently prioritised the general population or hospitalised patients to capture broader public health trends or severe disease outcomes and inadvertently overlooked HCWs and their unique risks and experiences. This has limited the insights into prevalence, risk factors, and socio-occupational impacts of long COVID in this population.

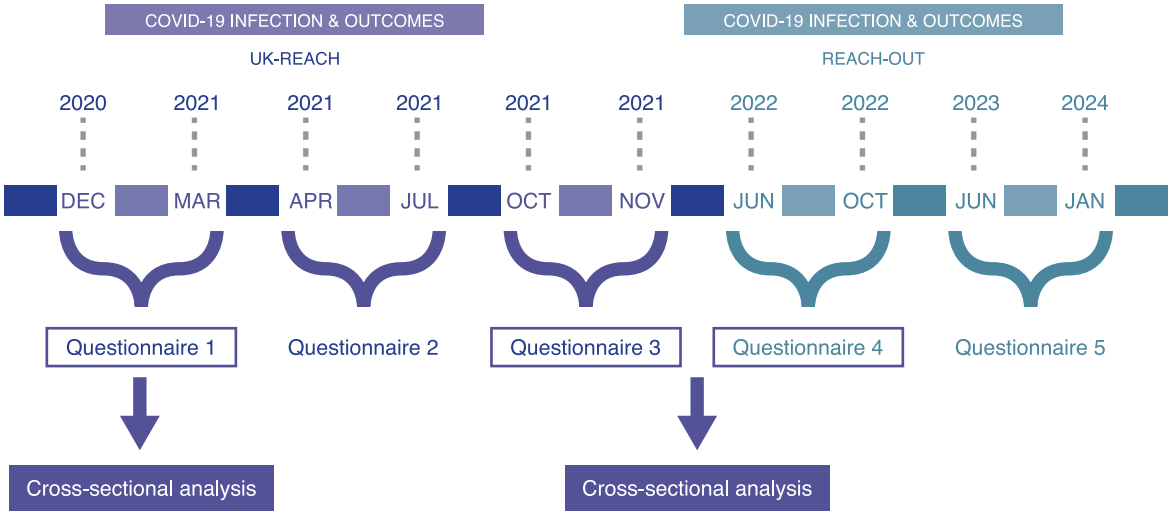
As such, we aimed to address these knowledge gaps using data from the UK-REACH study.

4.2 Methods

4.2.1 Overview

This analysis was based on data from the baseline questionnaire of the UK-REACH nationwide cohort study collected between December 2020 and March 2021 as shown in **Figure 4.1.** The study protocol,[112] the cohort profile,[113] and data dictionary (https://www.uk-reach.org/data-dictionary) provide detailed information on the study design, sampling, and measures.

Figure 4.1. Overview of UK-REACH and REACH-OUT questionnaires



Outcome measures

Our primary outcome was long COVID which was defined as symptoms that persisted for more than 5 weeks. This is because the questionnaire was developed early in the pandemic before long COVID became a recognised term with an established definition. To align with the current standard definition of post-COVID-19 syndrome by NICE,[119] we conducted a sensitivity analysis using the 12-week cut-off.

The cohort we analysed consisted of participants who self-reported being infected with SARS-CoV-2 infection. A participant's history of SARS-CoV-2 infection was derived from answers to the question "Do you think that you currently have or have had COVID-19?" Those who answered "Yes, my own suspicions", "Yes, suspected by a doctor but not tested" or "Yes, confirmed by a positive test" were considered to have had COVID-19. Those who reported having had COVID-19 were additionally asked: "How long have you been unwell since having COVID-19?" Those who indicated that they were unwell for five weeks or longer since having COVID-19 were considered to have had long COVID.

Those who indicated they were unwell for 3-5 weeks or shorter were consider not to have had long COVID.

4.2.2 Exposure

Our primary exposure of interest was self-reported ethnicity, which we classified according to the 5- and 18-level ethnic group categories provided by ONS.[114] We used the 5-level variable (White, Asian, Black, Mixed, and Other) in the primary analysis to ensure sufficient statistical power for detecting differences between these groups.

4.2.3 Covariates

We included demographic characteristics such as age, sex, and migration status. Job roles were categorised into 5 groups: (1) Doctor or medical support, (2) Nurse, Nursing Assistant (NA), or Midwife, (3) AHP, which also includes pharmacists, healthcare scientists, ambulance workers, and those in optical roles, (4) Dental, and (5) Admin, estates, or other roles.

Household, residential, and social factors were also considered, specifically the Index of Multiple Deprivation (IMD), the official measure of relative deprivation for small areas in England, expressed as quintiles.[157] Alcohol consumption was measured on a scale from 1 to 5 to represent the frequency of alcohol intake, and smoking status was also included. BMI was categorised into four groups: (1) BMI < 25, (2) BMI ≥ 25 and < 30, (3) BMI ≥ 30 and < 40, and (4) BMI ≥ 40. Additionally, self-reported comorbidities were accounted for, including diabetes (type 1 or type 2), asthma, other lung conditions (such as chronic obstructive pulmonary disease [COPD], bronchitis, and emphysema), depression, anxiety, and cardiovascular diseases (CVDs). [31]

A description of each variable and how it was derived from questionnaire responses can be found in **Table 4.1.**

Table 4.1 Derivation of covariates from baseline questionnaire data

Variable	Description
Age	Continuous variable. Age in years. Derived from date of birth entered by participants at registration.
Sex	Binary variable. Participants were asked their sex assigned at birth.
Ethnicity	Categorical variable. Participants were asked to select their ethnicity from a list of the 18 Office for National Statistics categories: Asian/Asian British – Indian Asian/Asian British – Pakistani Asian/Asian British – Bangladeshi Asian/Asian British – Chinese Asian/Asian British - Any other Asian background Black/African/Caribbean/Black British - African Black/African/Caribbean/Black British – Caribbean Black/African/Caribbean/Black British - Any other Black/African/Caribbean background Mixed/Multiple ethnic groups - White and Black Caribbean Mixed/Multiple ethnic groups - White and Black African Mixed/Multiple ethnic groups - White and Asian Mixed/Multiple ethnic groups - Any other Mixed/multiple ethnic background White - English/Welsh/Scottish/Northern Irish/British White – Irish White - Gypsy or Irish Traveller White - Any other white background Other ethnic group – Arab Other ethnic group - Any other ethnic background These were categorised into the 5 broader Office for National Statistics ethnicity categories (Asian, Black, Mixed, White, Other).
Migration status	Binary variable. Participants were asked whether they were born in the UK.
Index of Multiple Deprivation (IMD) quintile	Ordinal variable. Participants provided their residential postcode on registration for the study. This was used to determine the Index of Multiple Deprivation (the official measure of deprivation for small areas of England) in the area in which they live. The IMD ranks all areas in England based on 7 measures of deprivation and the ranks can be expressed as quintiles. Lower quintiles indicate more deprivation. Although Wales, Scotland and Northern Ireland have their own measures of deprivation, these are said not to be directly comparable to English IMD and therefore we elected to impute an 'English IMD' for residents of the these nations.
Comorbidities	
Diabetes	Binary variable. Participants were asked to indicate if they had "diabetes (type I or II)"
Other lung conditions	Binary variable. Participants were asked to indicate if they had other lung condition such as COPD, bronchitis or emphysema.
Depression	Binary variable. Participants were asked to indicate if they had depression
Anxiety	Binary variable. Participants were asked to indicate if they had anxiety
Asthma	Binary variable. Participants were asked to indicate if they had asthma
Other cardiovascular diseases	Binary variable. Participants were asked to indicate if they had Heart disease or heart problems and/or Hypertension, and/or stroke. These conditions were used to derive this variable.

Body Mass Index (BMI)	Ordinal variable. Participants were asked to provide their weight and height. The BMI was then calculated as the ratio of weight in kilograms (weightkg) to height squared in meters (heightcm/100)^2. To categorise the BMI, we created a ordinal variable with the following categories:1"<25" 2">=25 & bmi <30" 3">=30 & bmi <40" 4">=40"
Alcohol consumption	Ordinal variable. Participants were asked to indicate how often do they have a drink containing alcohol. Then they were categorised based how often they drink alcohol to the following categories:1" non-drinker" 2"monthly or less" 3"2 - 4 times per month" 4"2 - 3 times per week" 5"4+ times per week
Smoking status	Categorical variable. Participants were asked to indicate if they do or have ever smoked tobacco. Then they were categorised to two main categories : 1"never/ ex-smoker,2" current smoker.
Occupation	Categorical variable. Participants were asked to select their main job/role. Categorised as below:
	Doctor or medical support - Doctor, Advanced Critical Care Practitioner, Anaesthesia associate, Surgical Care Practitioner, Other medical associate
	Nurse, NA or Midwife - Advanced Nurse Practitioner, Healthcare assistant, Maternity support worker, Midwife, Nurse, Nursing Associate, Other nursing and midwifery role,
	Allied Health Professional (including pharmacists, ambulance workers and those in optical roles) - Arts therapist, Biomedical scientist, Chiropodist/ Podiatrist, Clinical scientist, Dietician, Hearing aid dispenser, Occupational therapist, Operating department practitioner, Orthoptist, Physiotherapist, Practitioner psychologist, Prosthetist / Orthotist, Radiographer, Speech and language therapist, Other Allied Health Professional role, Emergency medical , Paramedic , Other ambulance role, OT Support , Phlebotomist, Physiotherapy Assistant, Radiography Other clinical support role , Pharmacist , Pharmacy technician, Other pharmacy role, Optical - Dispensing optician, Optometrist, Other Optical role
	Dental - Clinical dental technician, Dental Hygienist, Dental nurse, Dental technician, Dentist, Other dental role
	Admin, estates or other – Administration, Catering services, Domestic services, Estates services, Porter, Other

4.2.4 Statistical analysis

We excluded those with missing data for the primary exposure and outcome of interest from all analyses. We were primarily interested in determining factors associated with long COVID in those with a history of acute SARS-CoV-2 infection and the association of ethnicity with long COVID.

We summarised categorical variables as frequencies and percentages, and non-normally distributed continuous variables as median averages and IQRs.
We used chi-square tests for categorical data and Kruskal-Wallis tests for continuous data.

We used univariable and multivariable logistic regression to determine unadjusted and adjusted associations between the variables described above and long COVID. Results as unadjusted and adjusted odds ratios (ORs and aORs) and 95% Cis were reported.

We reported frequency and percentage of observations with missing data for each variable of interest, both overall and stratified by ethnicity.

We used multiple imputation by chained equations to impute missing data in these logistic regression models.[158] We also used Rubin's rules to combine the parameter estimates and standard errors from 10 imputations into a single set of results.[159]

The imputation models used in the final analyses included all variables, including the outcome measure.

To investigate the extent to which differences in long COVID risk by ethnic group could be explained by other related risk factors we generated a base logistic regression model (i.e., the minimally adjusted model) in which we adjusted for basic demographic/occupational variables (i.e., age, sex, migration status, and job role). We then added additional variables to explore the health and lifestyle factors including IMD, existing comorbidities, BMI, smoking status, and alcohol consumption to this base model which we called "fully-adjusted model" to assess whether these factors may contribute to ethnic differences in long COVID prevalence.

A sensitivity analysis was conducted using only observations with complete data in all covariates. We also conducted a sensitivity analysis of HCWs reporting symptoms persisting for ≥12 weeks consistent with the NICE definition of long COVID. This analysis aimed to identify specific factors associated with prolonged symptom duration, thereby contributing to a more nuanced understanding of long COVID and exploring potential variations from the findings of my primary analysis. We performed all analyses and multiple imputations using Stata 17 (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.).[160]

4.3 Results

4.3.1 Cohort recruitment and formation of the analysis sample

Figure 4.2 illustrates the formation of the analysed cohort. This is explained in detail, including the response rates, in previous publications from UK-REACH study.[112,113] In summary, 11,513 HCWs formed the analysis sample, of whom 2,331 (20.2%) reported having had COVID-19.

4.3.2 Description of the analysed cohort

A description of the analysed cohort (N=2,331) cohort, stratified by ethnicity, is shown in **Table 4.2.** Almost all of the predictor variables significantly differed by ethnicity. Age was significantly different by ethnic group (p<0.001), Black and Asian cohorts were younger on average than White cohorts (Black 39 [IQR 33 – 53], Asian 39 [IQR 31 – 48], and White 44 [33 – 54]). A greater proportion of Black HCWs lived in areas corresponding to lower IMD quintiles than White HCWs. Migration status was also significantly different by ethnic group (p<0.001) with much greater proportions of Black, Asian, and Other HCWs being born outside the

UK compared to the White cohort (63.2% [Black], 55.3% [Asian], 73.2% [Other] vs 12.6% [White]).

Ethnic distribution was not equal across different reported long-term conditions. Self-reported depression and anxiety were notably higher in the White cohort compared to Asian, Black, Mixed, and Other groups, while comorbidities like asthma and other lung conditions showed less variability across the ethnic groups **(Table 4.2).**

Table 4.2.

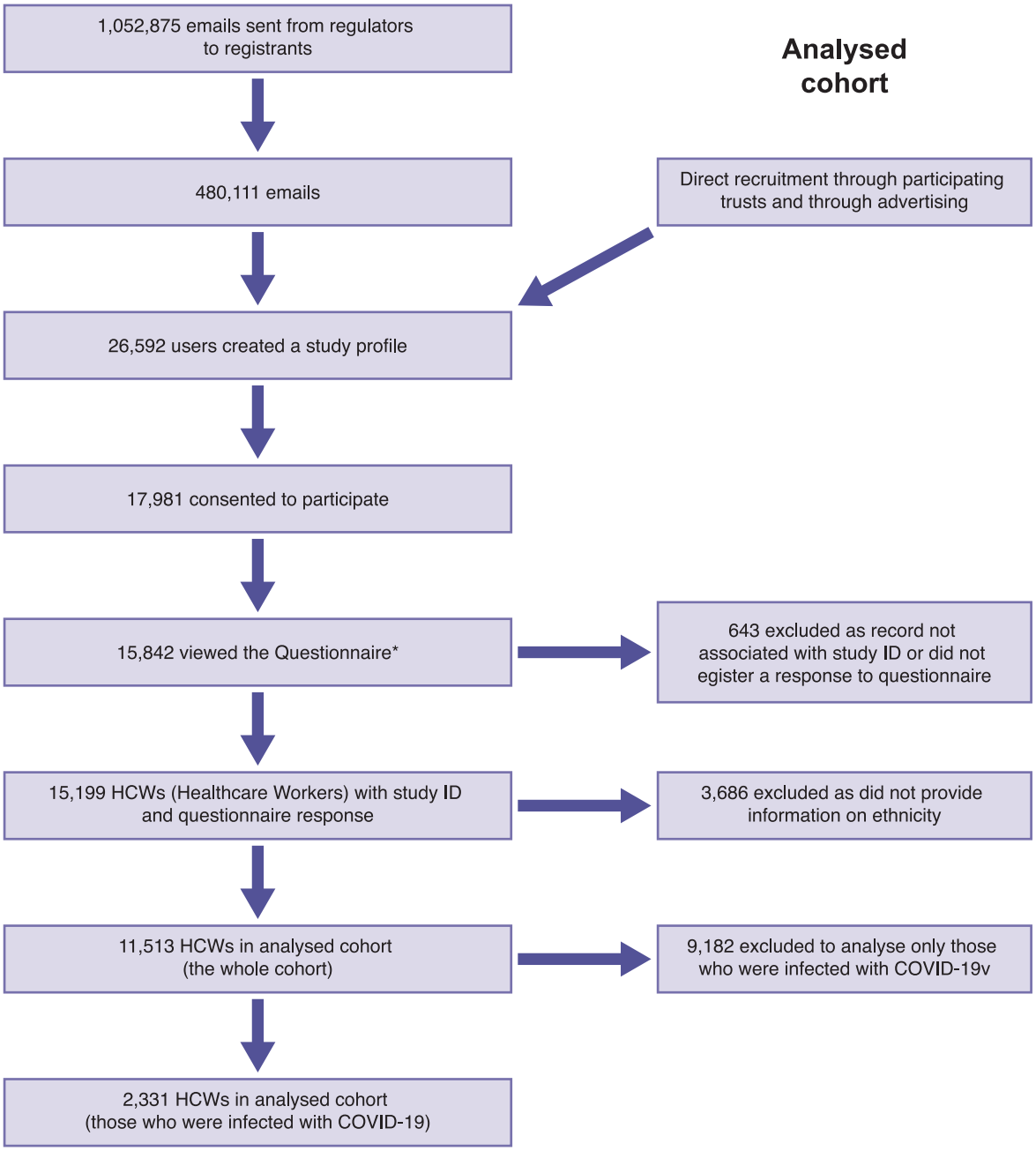
Variable	Analysed cohort (n=2,331)	White	Asian	Black	Mixed	Other	P-value
Age, median (IQR)	42 (32 – 53)	44 (33 – 54)	39 (31 – 48)	39 (33 – 53)	34 (30 – 45)	40.5 (32 – 47)	<0.001
Sex							
Male	559 (24.0%)	344 (20.3%)	141 36.3%)	25 (26.3%)	32 (29.9%)	17 (41.5%)	<0.001
Female	1,762 (75.6%)	1,347 (79.3%)	248 (63.8%)	68 (71.6%)	75 (70.1%)	24 (58.5%)	
Missing	10 (0.43%)	8 (0.5%)	0 (0.0%)	2 (2.1%)	0 (0.0%)	0 (0.0%)	
Migration status							
Born in UK	1,786 (76.6%)	1,485 (87.4%)	173 (44.5%)	35 (36.8%)	82 (76.6%)	11 (26.8%)	<0.001
Born abroad	544 (23.3%)	214 (12.6%)	215 (55.3%)	60 (63.2%)	25 (23.4%)	30 (73.2%)	
Missing	1 (0.04%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Index of multiple deprivation quintile							
1 (most deprived)							<0.001
2	226 (9.7%)	123 (7.2%)	62 (15.9%)	26 (27.4%)	11 (10.3%)	4 (9.8%)	
3	369 (15.8%)	251 (14.8%)	78 (20.1%)	19 (20.0%)	15 (14.0%)	6 (14.6%)	
4	412 (17.7%)	299 (17.6%)	66 (17.0%)	12 (12.6%)	23 (21.5%)	12 (29.3%)	
5 (least deprived)	492 (21.1%)	368 (21.7%)	85 (21.9%)	15 (15.8%)	19 (17.8%)	5 (12.2%)	
	579 (24.8%)	447 (26.3%)	70 (18.0%)	19 (20.0%)	34 (31.8%)	9 (22.0%)	
Missing	253 (10.9%)	211 (12.4%)	28 (7.2%)	4 (4.21%)	5 (12.2%)	5 (12.2%)	
Comorbidities							
Not diabetic	2,141 (91.9%)	1,575 (92.7%)	348 (89.5%)	84 (88.4%)	96 (89.7%)	38 (92.7%)	0.020
Diabetic	85 (3.7%)	51 (3.0%)	23 (5.9%)	6 (6.3%)	5 (4.7%)	0 (0.0%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	

Comorbidities							
No other lung conditions	2,206 (94.6%)	1,612 (94.9%)	369 (94.9%)	90 (94.7%)	98 (91.6%)	37 (90.2%)	0.110
Other lung conditions	20 (0.9%)	14 (0.8%)	2 (0.5%)	0 (0.0%)	3 (2.8%)	1 (2.4%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No depression	1,964 (84.3%)	1,407 (82.8%)	346 (89.0%)	86 (90.5%)	89 (83.2%)	36 (87.8%)	0.001
Depression	262 (11.2%)	219 (12.9%)	25 (6.4%)	4 (4.2%)	12 (11.2%)	2 (4.9%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No anxiety	1,875 (80.4%)	1,339 (78.8%)	335 (86.1%)	82 (86.3%)	84 (78.5%)	35 (85.4%)	0.001
Anxiety	351 (15.1%)	287 (16.9%)	36 (9.3%)	8 (8.4%)	17 (15.9%)	3 (7.3%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
Not asthmatic	1,913 (82.1%)	1,394 (82.1%)	328 (84.3%)	79 (83.2%)	78 (72.9%)	34 (82.9%)	0.063
Asthmatic	313 (13.4%)	232 (13.7%)	43 (11.1%)	11 (11.6%)	23 (21.5%)	4 (9.8%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No other CVDs *	2,102 (86.3%)	1,474 (86.8%)	328 (84.3%)	79 (83.2%)	95 (88.8%)	36 (87.8%)	0.298
Other CVDs	214 (9.2%)	152 (9.0%)	43 (11.1%)	11 (11.6%)	6 (5.6%)	2 (4.9%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Body Mass Index							
<25	990 (42.5%)	706 (41.6%)	193 (49.6%)	23 (24.2%)	53 (49.5%)	15 (36.6%)	
>=25 & <30	659 (28.3%)	453 (26.7%)	125 (32.1%)	35 (36.8%)	28 (26.2%)	18 (43.9%)	
>=30 & <40	380 (16.3%)	304 (17.9%)	42 (10.8%)	13 (13.7%)	15 (14.0%)	6 (14.6%)	
>=40	63 (2.7%)	52 (3.1%)	3 (0.8%)	5 (5.3%)	3 (2.8%)	0 (0.0%)	<0.001
missing	239 (10.3%)	184 (10.8%)	26 (6.7%)	19 (20.0%)	8 (7.5%)	2 (4.9%)	
Alcohol consumption							
1 (non-drinker)	371 (15.9%)	146 (8.6%)	164 (42.2%)	33 (34.7%)	14 (13.1%)	14 (34.2%)	<0.001
2 (monthly or less)	545 (23.4%)	387 (22.8%)	90 (23.1%)	34 (35.8%)	24 (22.4%)	10 (24.4%)	
3 (2 - 4 times per month)	594 (25.5%)	450 (26.5%)	83 (21.3%)	22 (23.2%)	31 (29.0%)	8 (19.5%)	
4 (2 - 3 times per week)	559 (24.0%)	491 (28.9%)	33 (8.5%)	4 (4.2%)	25 (23.4%)	6 (14.6%)	
5 (4+ times per week)	251 (10.8%)	219 (12.9%)	16 (4.1%)	2 (2.1%)	12 (11.2%)	2 (4.9%)	
missing	11 (0.5%)	6 (0.4%)	3 (0.8%)	0 (0.0%)	1 (0.9%)	1 (1.4%)	

Smoking status							
Never/ex-smoker	2,205 (94.6%)	1,606 (94.5%)	369 (94.9%)	91 (95.8%)	101 (94.4%)	38 (92.7%)	0.758
Current smoker	101 (4.3%)	77 (4.5%)	14 (3.6%)	3 (3.2%)	4 (3.7%)	3 (7.3%)	
Missing	25 (1.1%)	16 (0.9%)	6 (1.5%)	1 (1.1%)	2 (1.9%)	0 (0.0%)	
Occupation							
Doctor or medical support	496 (21.3%)	220 (13.0%)	180 (46.3%)	30 (31.2%)	41 (38.3%)	25 (61.0%)	<0.001
Nurse, NA[a] or Midwife	524 (22.5%)	459 (27.0%)	27 (6.9%)	21 (22.1%)	16 (14.6%)	1 (2.4%)	
Allied Health Professional**	1,018 (43.7%)	806 (47.4%)	130 (33.4%)	29 (30.5%)	42 (39.3%)	11 (26.8%)	
Dental	11 (4.8%)	81 (4.8%)	20 (5.1%)	7 (7.4%)	2 (1.9%)	1 (2.4%)	
Admin, estates or other	97 (4.2%)	80 (4.7%)	11 (2.8%)	4 (4.2%)	1 (0.9%)	1 (2.4%)	
missing	85 (3.7%)	53 (3.1%)	21 (5.4%)	4 (4.2%)	5 (4.7%)	2 (4.9%)	

**heart diseases, heart problem, stroke, HTN*
***Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*
[a] *Nursing Associate*

Figure 4.2. Formation of the analysed cohort



HCW – Healthcare worker (those in professional healthcare roles or ancillary workers in a healthcare setting or registered with one of the seven participating UK healthcare professional regulatory bodies – see methods for a list of participating regulatory bodies).
*There were 15997 views of the questionnaire, 155 duplicate records were removed leaving 15,842 unique HCW views.
†corresponds to an effective response rate of 57.1% of those who registered/created a profile on the study website (and 84.5% of those who consented, 1.4% of those who were sent an email and 3.2% of those who opened the email).

Table 4.2. Description of the analysed cohort stratified by ethnicity together with tests of association between predictor variables and ethnicity

Variable	Analysed cohort (n=2,331)	White	Asian	Black	Mixed	Other	P-value
Age, median(IQR)	42 (32 – 53)	44 (33 – 54)	39 (31 – 48)	39 (33 – 53)	34 (30 – 45)	40.5 (32 – 47)	<0.001
Sex							
Male	559 (24.0%)	344 (20.3%)	141(36.3%)	25 (26.3%)	32 (29.9%)	17 (41.5%)	<0.001
Female	1,762 (75.6%)	1,347 (79.3%)	248 (63.8%)	68 (71.6%)	75 (70.1%)	24 (58.5%)	
Missing	10 (0.43%)	8 (0.5%)	0 (0.0%)	2 (2.1%)	0 (0.0%)	0 (0.0%)	
Migration status							
Born in UK	1,786 (76.6%)	1,485 (87.4%)	173 (44.5%)	35 (36.8%)	82 (76.6%)	11 (26.8%)	<0.001
Born abroad	544 (23.3%)	214 (12.6%)	215 (55.3%)	60 (63.2%)	25 (23.4%)	30 (73.2%)	
Missing	1 (0.04%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Index of multiple deprivation quintile							
1 (most deprived)	226 (9.7%)	123 (7.2%)	62 (15.9%)	26 (27.4%)	11 (10.3%)	4 (9.8%)	<0.001
2	369 (15.8%)	251 (14.8%)	78 (20.1%)	19 (20.0%)	15 (14.0%)	6 (14.6%)	
3	412 (17.7%)	299 (17.6%)	66 (17.0%)	12 (12.6%)	23 (21.5%)	12 (29.3%)	
4	492 (21.1%)	368 (21.7%)	85 (21.9%)	15 (15.8%)	19 (17.8%)	5 (12.2%)	
5 (least deprived)	579 (24.8%)	447 (26.3%)	70 (18.0%)	19 (20.0%)	34 (31.8%)	9 (22.0%)	
Missing	253 (10.9%)	211 (12.4%)	28 (7.2%)	4 (4.21%)	5 (12.2%)	5 (12.2%)	
Comorbidities							
Not diabetic	2,141 (91.9%)	1,575 (92.7%)	348 (89.5%)	84 (88.4%)	96 (89.7%)	38 (92.7%)	0.020
Diabetic	85 (3.7%)	51 (3.0%)	23 (5.9%)	6 (6.3%)	5 (4.7%)	0 (0.0%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No other lung conditions	2,206 (94.6%)	1,612 (94.9%)	369 (94.9%)	90 (94.7%)	98 (91.6%)	37 (90.2%)	0.110
Other lung conditions	20 (0.9%)	14 (0.8%)	2 (0.5%)	0 (0.0%)	3 (2.8%)	1 (2.4%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No depression	1,964 (84.3%)	1,407 (82.8%)	346 (89.0%)	86 (90.5%)	89 (83.2%)	36 (87.8%)	0.001
Depression	262 (11.2%)	219 (12.9%)	25 (6.4%)	4 (4.2%)	12 (11.2%)	2 (4.9%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No anxiety	1,875 (80.4%)	1,339 (78.8%)	335 (86.1%)	82 (86.3%)	84 (78.5%)	35 (85.4%)	0.001
Anxiety	351 (15.1%)	287 (16.9%)	36 (9.3%)	8 (8.4%)	17 (15.9%)	3 (7.3%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
Not asthmatic	1,913 (82.1%)	1,394 (82.1%)	328 (84.3%)	79 (83.2%)	78 (72.9%)	34 (82.9%)	0.063
Asthmatic	313 (13.4%)	232 (13.7%)	43 (11.1%)	11 (11.6%)	23 (21.5%)	4 (9.8%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	
Comorbidities							
No other CVDs *	2,102 (86.3%)	1,474 (86.8%)	328 (84.3%)	79 (83.2%)	95 (88.8%)	36 (87.8%)	0.298
Other CVDs	214 (9.2%)	152 (9.0%)	43 (11.1%)	11 (11.6%)	6 (5.6%)	2 (4.9%)	
Missing	105 (4.5%)	73 (4.3%)	18 (4.6%)	5 (5.3%)	6 (5.6%)	3 (7.3%)	

Body Mass Index							
<25	990 (42.5%)	706 (41.6%)	193 (49.6%)	23 (24.2%)	53 (49.5%)	15 (36.6%)	
>=25 & <30	659 (28.3%)	453 (26.7%)	125 (32.1%)	35 (36.8%)	28 (26.2%)	18 (43.9%)	
>=30 & <40	380 (16.3%)	304 (17.9%)	42 (10.8%)	13 (13.7%)	15 (14.0%)	6 (14.6%)	
>=40	63 (2.7%)	52 (3.1%)	3 (0.8%)	5 (5.3%)	3 (2.8%)	0 (0.0%)	<0.001
Missing	239 (10.3%)	184 (10.8%)	26 (6.7%)	19 (20.0%)	8 (7.5%)	2 (4.9%)	
Alcohol consumption							
1 (non-drinker)	371 (15.9%)	146 (8.6%)	164 (42.2%)	33 (34.7%)	14 (13.1%)	14 (34.2%)	<0.001
2 (monthly or less)	545 (23.4%)	387 (22.8%)	90 (23.1%)	34 (35.8%)	24 (22.4%)	10 (24.4%)	
3 (2 - 4 times per month)	594 (25.5%)	450 (26.5%)	83 (21.3%)	22 (23.2%)	31 (29.0%)	8 (19.5%)	
4 (2 - 3 times per week)	559 (24.0%)	491 (28.9%)	33 (8.5%)	4 (4.2%)	25 (23.4%)	6 (14.6%)	
5 (4+ times per week)	251 (10.8%)	219 (12.9%)	16 (4.1%)	2 (2.1%)	12 (11.2%)	2 (4.9%)	
Missing	11 (0.5%)	6 (0.4%)	3 (0.8%)	0 (0.0%)	1 (0.9%)	1 (1.4%)	
Smoking status							
Never/ex-smoker	2,205 (94.6%)	1,606 (94.5%)	369 (94.9%)	91 (95.8%)	101 (94.4%)	38 (92.7%)	0.758
Current smoker	101 (4.3%)	77 (4.5%)	14 (3.6%)	3 (3.2%)	4 (3.7%)	3 (7.3%)	
Missing	25 (1.1%)	16 (0.9%)	6 (1.5%)	1 (1.1%)	2 (1.9%)	0 (0.0%)	
Occupation							
Doctor or medical support	496 (21.3%)	220 (13.0%)	180 (46.3%)	30 (31.2%)	41 (38.3%)	25 (61.0%)	<0.001
Nurse, NA[a] or Midwife	524 (22.5%)	459 (27.0%)	27 (6.9%)	21 (22.1%)	16 (14.6%)	1 (2.4%)	
Allied Health Professional**	1,018 (43.7%)	806 (47.4%)	130 (33.4%)	29 (30.5%)	42 (39.3%)	11 (26.8%)	
Dental	11 (4.8%)	81 (4.8%)	20 (5.1%)	7 (7.4%)	2 (1.9%)	1 (2.4%)	
Admin, estates or other	97 (4.2%)	80 (4.7%)	11 (2.8%)	4 (4.2%)	1 (0.9%)	1 (2.4%)	
Missing	85 (3.7%)	53 (3.1%)	21 (5.4%)	4 (4.2%)	5 (4.7%)	2 (4.9%)	

**heart diseases, heart problem, stroke, HTN*
***Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*
[a] *Nursing Associate*

Table 4.3 presents a description of the analysed cohort. The majority of participants (75.6%) were female and the median age was 42 years (IQR: 33 – 52). Approximately 27% of the cohort were from an ethnic minority group (16.7% Asian, 4.1% Black, 4.6% Mixed, and 1.8% Other). 23.3% were born outside the UK.

Table 4.3. Description of the analysed cohort

Variable	**Total cohort N=11,513** **Analysed cohort Those who were infected with COVID-19 N=2,331**
Ethnicity	
White	1,699 (72.9%)
Asian	389 (16.7%)
Black	95 (4.1%)
Mixed	107 (4.6%)
Other	41 (1.8%)
Missing	0 (0.0%)

Migration Status	
Born in UK	1,786 (76.6%)
Born abroad	544 (23.3%)
Missing	1 (0.0%)
Age, median (IQR)	42 (33 – 52)
Missing	17 (0.7%)
Sex	
Male	559 (24.0%)
Female	1,762 (75.6%)
Missing	10 (0.4%)
Index of multiple deprivation quintile	
1 (most deprived)	226 (9.7%)
2	369 (15.8%)
3	412 (17.7%)
4	492 (21.1%)
5 (least deprived)	579 (24.8%)
Missing	253 (10.9%)
Comorbidities	
Not diabetic	1,666 (92.3%)
Diabetic	57 (3.2%)
Missing	83 (4.6%)
Comorbidities	
No other lung conditions	2,206 (94.6%)
Other lung conditions	20 (0.9%)
Missing	105 (4.5%)
Comorbidities	
No depression	1,964 (84.3%)
Depression	262 (11.2%)
Missing	105 (4.5%)
Comorbidities	
No anxiety	1,875 (80.4%)
Anxiety	351 (15.1%)
Missing	105 (4.5%)
Comorbidities	
Not asthmatic	1,913 (82.1%)
Asthmatic	313 (13.4%)
Missing	105 (4.5%)
Comorbidities	
No other CVDs a	2,012 (86.3%)
Other CVDs	214 (9.2%)
Missing	105 (4.5%)

Body Mass Index	
<25	990 (42.5 %)
≥ 25 & <30	659 (28.3%)
≥ 30 & <40	380 (16.3%)
≥ 40	63 (2.7%)
Missing	239 (10.3%)
Alcohol consumption	
1 (non-drinker)	371 (15.9%)
2 (monthly or less)	545 (23.4%)
3 (2 - 4 times per month)	594 (25.5%)
4 (2 - 3 times per week)	559 (24.0%)
5 (4+ times per week)	251 (10.8%)
Missing	11 (0.5%)
Smoking status	
Never/ex-smoker	2,205 (94.6%)
Current smoker	101 (4.3%)
Missing	25 (1.1%)
Occupation	
Doctor or medical support	496 (21.3%)
Nurse, NA or Midwife	524 (22.5%)
Allied Health Professional*	1,018 (43.7%)
Dental	111 (4.8%)
Admin, estates or other	97 (4.2%)
Missing	85 (3.7%)

[a] *Heart diseases, heart problem, stroke, HTN*
**Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*

4.3.3 Prevalence of long COVID

Overall, we found that among HCWs with a self-reported history of acute COVID-19 (N=2,331), 22.5% (525/2,331) experienced long COVID. 21.7% of those who experienced long COVID were from ethnic minority groups, compared with 28.6% who did not experience long COVID. Amongst those who reported long COVID, 17.3% were born abroad, compared to 25.1% amongst those who did not report long COVID. Differences in prevalence between other variables are shown in **Tables 4.4** and **4.3.** In sensitivity analyses, we found that 13.6% (316/2,331) of HCWs experienced symptoms lasting more than three months, and 9.2% (215/2,331) experienced symptoms lasting more than six months. Of those, 20.6% (65/316) and 17.7% (38/215) were from ethnic minorities, respectively (see **Table 4.5**). Ethnic distribution of HCWs experiencing long COVID symptoms by duration table is shown in Supplementary Material 3.

Table 4.4. Characteristics and distribution of the variables in the cohort

Variable	Total cohort N=11,513	
	Those who were infected with COVID-19 N=2,331	
	No long COVID 1,806 -77.50%	Long COVID 525 -22.50%
Ethnicity		
White	1,288 (71.3%)	411 (78.3%)
Asian	320 (17.7%)	69 (13.1%)
Black	82 (4.5%)	13 (2.5%)
Mixed	83 (4.6%)	24 (4.6%)
Other	33 (1.8%)	8 (1.5%)
Missing	0 (0.0%)	0 (0.0%)
Migration Status		
Born in UK	1,352 (74.9%)	434 (82.7%)
Born abroad	453 (25.1%)	91 (17.3%)
Missing	1 (0.1%)	0 (0.0%)
Age, median (IQR)	41 (31 – 52)	46 (36 – 54)
Missing	14 (0.8%)	3 (0.6%)
Sex		
Male	455 (25.2%)	104 (19.8%)
Female	1,342 (74.3%)	420 (80.0%)
Missing	9 (0.5%)	1 (0.2%)
Index of multiple deprivation quintile		
1 (most deprived)	165 (9.1%)	61 (11.6%)
2	290 (16.1%)	79 (15.01%)
3	323 (17.9%)	89 (17.0%)
4	386 (21.4%)	106 (20.2%)
5 (least deprived)	458 (25.4%)	121 (23.1%)
Missing	184 (10.2%)	69 (13.1%)
Comorbidities		
Not diabetic	1,666 (92.3%)	475 (90.5%)
Diabetic	57 (3.2%)	28 (5.3%)
Missing	83 (4.6%)	22 (4.2%)
Comorbidities		
No other lung conditions	1,715 (95.0%)	491 (93.5%)
Other lung conditions	8 (0.4%)	12 (2.3%)
Missing	83 (4.6%)	22 (4.2%)

Comorbidities		
No depression	1,559 (86.3%)	405 (77.1%)
Depression	164 (9.1%)	98 (18.7%)
Missing	83 (4.6%)	22 (4.2%)
Comorbidities		
No anxiety	1,494 (82.7%)	381 (72.6%)
Anxiety	229 (12.7%)	122 (23.2%)
Missing	83 (4.6%)	22 (4.2%)
Comorbidities		
Not asthmatic	1,515 (83.9%)	398 (75.8%)
Asthmatic	208 (11.5%)	105 (20.0%)
Missing	83 (4.6%)	22 (4.2%)
Comorbidities		
No other CVDs [a]	1,581 (87.4%)	431 (82.1%)
Other CVDs	142 (7.9%)	72 (13.7%)
Missing	83 (4.6%)	22 (4.2%)
Body Mass Index		
<25	803 (16.0%)	187 (3.7%)
≥ 25 & <30	511 (15.6%)	148 (4.5%)
≥ 30 & <40	269 (14.9%)	111 (6.2%)
≥ 40	42 (15.2%)	21 (7.6%)
Missing	181 (15.8%)	58 (5.1%)
Alcohol consumption		
1 (non-drinker)	284 (15.7%)	87 (16.6%)
2 (monthly or less)	407 (22.5%)	138 (26.3%)
3 (2 - 4 times per month)	463 (25.1%)	131 (25.0%)
4 (2 - 3 times per week)	453 (25.1%)	106 (20.1%)
5 (4+ times per week)	191 (10.6%)	60 (11.4%)
Missing	8 (0.4%)	3 (0.6%)
Smoking status		
Never/ex-smoker	1,703 (94.3%)	502 (95.6%)
Current smoker	80 (4.4%)	21 (4.0%)
Missing	23 (1.3%)	2 (0.4%)
Occupation		
Doctor or medical support	415 (23.0%)	81 (15.4%)
Nurse, NA or Midwife	327 (20.1%)	152 (29.0%)

Allied Health Professional**	786 (43.5%)	232 (44.2%)
Dental	92 (5.1%)	19 (3.6%)
Admin, estates or other	75 (4.2%)	22 (4.2%)
Missing	66 (3.7%)	19 (3.6%)

**Includes those who have not had COVID-19 and those who have had COVID-19 without prolonged symptoms*
***Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*
[a] *heart diseases, heart problem, stroke, HTN*

Table 4.5. Prevalence of long COVID by duration of symptoms

Duration	Total N=2,331	
	No long COVID	Long COVID
More than 5 weeks	1,806 (77.48%)	525 (22.52%)
More than 3 months	2,015 (86.44%)	316 (13.56%)
More than 6 months	2,116 (90.78%)	215 (9.22%)

4.3.4 Univariable analysis of risk factors for long COVID

Demographic risk factors

Table 4.6 presents the unadjusted ORs for the association of covariates with long COVID among HCWs with a self-reported history of COVID-19 (N=2,331). The odds of HCWs of Black ethnicity (OR 0.50, 95% CI 0.27 – 0.90, p=0.021) or Asian ethnicity (OR 0.68, 95% CI 0.51 – 0.90, p=0.007) experiencing long COVID were lower than for HCWs of White ethnicity. HCWs who were born abroad also had lower odds of experiencing long COVID than those born in the UK (OR 0.62, 95% CI 0.49 – 0.80, p<0.001).

Compared to HCW participants who did not have long COVID, participants with long COVID were older (OR 1.24, 95% CI 1.14 – 1.35, p=<0.001) and more likely to be female (OR 1.37, 95% CI 1.08 – 1.74, p=0.010) (**Table 4.6**).

Occupational risk factors

The odds of experiencing long COVID for HCWs in nursing roles were higher than that of those in medical roles (OR 2.12, 95% CI 1.57 – 2.87, p<0.001) as shown in **Table 4.6.** Additionally, AHPs had higher odds of experiencing long COVID compared to medical roles (OR 1.52, 95% CI 1.15 – 2.02, p=0.003).

Health risk factors

HCWs with the self-reported comorbidities of diabetes, asthma, other lung conditions, CVDs, depression, and anxiety were more likely to experience long COVID compared to those who did not report having these conditions (**Table 4.6**). Those who had a BMI of ≥30 to <40kg/m2 were more likely to have reported long COVID compared with those a BMI of <25kg/m2 (OR 1.76, 95% CI 1.33 – 2.23, p<0.001).

Table 4.6. Description of the cohort with unadjusted odds ratios for the association of covariates with long COVID (those who were infected with COVID-19)

Variable	Total N=2,331	
	Unadjusted OR (95% CI)	P-value
Ethnicity		
White	Ref	
Asian	0.68 (0.51 – 0.90)	0.007
Black	0.50 (0.27 – 0.90)	0.021
Mixed	0.91 (0.57 – 1.45)	0.68
Other	0.76 (0.35 – 1.66)	0.49
Migration Status		
Born in UK	Ref	-
Born abroad	0.62 (0.49 – 0.80)	<0.001
Age, per decade increase	1.24 (1.14 – 1.35)	<0.001
Sex		
Male	Ref	-
Female	1.37 (1.08 – 1.74)	0.01
Index of multiple deprivation quintile		
1 (most deprived)	Ref	-
2	0.75 (0.51 – 1.11)	0.15
3	0.75 (0.52 – 1.09)	0.128
4	0.74 (0.52 – 1.05)	0.088
5 (least deprived)	0.72 (0.51 – 1.03)	0.07
Comorbidities		
Not diabetic	Ref	-
Diabetic	1.69 (1.07 – 2.69)	0.026
Comorbidities		
No depression	Ref	-
Depression	2.30 (1.75 – 3.01)	<0.001
Comorbidities		
No anxiety	Ref	-
Anxiety	2.08 (1.62 – 2.66)	<0.001
Comorbidities		
No other CVDs [a]	Ref	-
Other CVDs	1.86 (1.38 – 2.52)	<0.001
Comorbidities		
Not asthmatic	Ref	-
Asthmatic	1.90 (1.47 – 2.47)	<0.001

Comorbidities		
No other lung conditions	Ref	-
Other lung conditions	5.31 (2.17 – 12.95)	<0.001
Body Mass Index		
<25	Ref	-
≥ 25 & <30	1.25 (0.99 – 1.59)	0.062
≥ 30 & <40	1.76 (1.33 – 2.32)	<0.001
≥ 40	2.15 (1.25 – 3.71)	0.006
Alcohol consumption		
1 (non-drinker)	Ref	-
2 (monthly or less)	1.10 (0.81 – 1.50)	0.53
3 (2 - 4 times per month)	0.92 (0.68 – 1.25)	0.596
4 (2 - 3 times per week)	0.76 (0.55 – 1.05)	0.095
5 (4+ times per week)	1.02 (0.70 – 1.48)	0.924
Smoking status		
Never/ex-smoker	Ref	-
Current smoker	0.89 (0.54 – 1.45)	0.64
Occupation		
Doctor or medical support	Ref	-
Nurse, NA or Midwife	2.12 (1.57 – 2.87)	<0.001
Allied Health Professional*	1.52 (1.15 – 2.02)	0.003
Dental	1.07 (0.61 – 1.87)	0.808
Admin, estates or other	1.54 (0.90 – 2.62)	0.113
OR: odds ratio		

95% CI: 95% confidence interval
Ref: reference category for categorical variables
**Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*
[a] *heart diseases, heart problem, stroke, HTN*

4.3.5 Multivariable analysis of risk factors for long COVID

Minimally adjusted model

Demographic and occupational factors

On multivariable analysis in a minimally adjusted model, I found that older HCWs were more likely to experience long COVID (aOR 1.23, 95% CI 1.13 – 1.34, p<0.001) for each decade increase in age. HCWs who were born outside the UK were less likely to experience long COVID compared to those born in the UK (aOR 0.55, 95% CI 0.55 – 0.97, p=0.031). Those working in nursing and midwifery roles (aOR 1.76, 95% CI 1.26 – 2.46, p=0.001) and AHPs (aOR 1.42, 95% CI 1.05– 1.93, p=0.023) were more likely to experience long COVID compared with medical roles (**Figure 4.3**).

Figure 4.3. Multivariable logistic regression demonstrating the factors associated with long COVID for HCWs with a history of SARS-CoV-2 infection (minimally adjusted)

Fully adjusted model

Demographic, occupational and health risk factors

On multivariable analysis in a fully adjusted model, we found that older HCWs had an increased risk with each decade increase in age leading to higher odds of experiencing long COVID (aOR 1.23, 95% CI 1.13 – 1.34, p < 0.001). Additionally, self-reported depression (aOR 1.50, 95% CI 1.07 – 2.11, p = 0.018) and anxiety (aOR 1.59, 95% CI 1.17 – 2.17, p < 0.001) were associated with an elevated risk of long COVID (**Figure 4.4**). Asthma was also a significant risk factor (aOR 1.88, 95% CI 1.43 – 2.48, p < 0.001). Alcohol consumption 2-3 times per week was associated with a lower risk of long COVID compared to those drinking no alcohol (aOR 0.63, 95% CI 0.44 – 0.91, p = 0.012).

Association of ethnicity with long COVID risk

There were no significant differences in risk of long COVID by ethnic group (**Figure 4.4**).

Figure 4.4. Multivariable logistic regression demonstrating the factors associated with long COVID for HCWs with a history of SARS-CoV-2 infection (fully adjusted)

4.3.6 Sensitivity analyses

Sensitivity analysis of factors associated with long COVID for those who self-reported having or have had COVID-19 preceding imputation did not significantly alter interpretation of the results of the primary analysis (i.e., the significant predictors remained the same).

We conducted two adjusted multivariable analyses of factors associated with long COVID that persists for longer than three months – fully adjusted (**Supplementary material 4**) OR and minimally adjusted OR (**Supplementary material 5**) – to identify unique factors related to prolonged symptoms for more than three months. In the fully adjusted model, HCWs who self-reported COVID-19, were born outside the UK, and experienced symptoms for more than three months were less likely to experience long COVID compared to those born in the UK (aOR 0.65, 95% CI 0.44 – 0.94, p=0.022). This was not statistically significant in the fully adjusted model of our primary analysis (see **Figure 4.4**)

4.4 Summary

We found that 22.5% of HCWs with a history of COVID-19 reported long COVID. Key risk factors identified included older age, female sex, and specific occupational roles, particularly nursing and AHPs. These associations were significant in minimally adjusted models but attenuated in fully adjusted models suggesting potential confounding effects or overadjustment. Health-related factors such as asthma, depression, anxiety, and obesity were also associated with increased odds of long COVID. Ethnicity showed variability in unadjusted and minimally adjusted models, but differences were not significant in fully adjusted models indicating that other covariates may explain these associations. Sensitivity analyses using NICE definition of long COVID (≥12 weeks) and complete case analysis reinforced the robustness of these findings. This highlights the need for targeted workplace interventions for high-risk groups, strategies to manage comorbidities, and further exploration of the socio-environmental factors contributing to long COVID risk. Future longitudinal studies are recommended to build on these findings and inform tailored interventions for HCWs.

5. PREVALENCE, PATTERNS OF LONG COVID SYMPTOMS AMONG HCWS IN THE UK AND VARIATIONS BY SOCIODEMOGRAPHIC, CLINICAL AND OCCUPATIONAL FACTORS: A CROSS-SECTIONAL ANALYSIS

5.1 Introduction

The NICE guidelines (2020) on long COVID recognises the need for further research to characterise common symptom clusters (phenotypes), risk factors, prognostic markers, natural history, and effective interventions for all age groups.[161] Additionally, it emphasises the importance of tackling health inequalities in the care of people with long COVID, including those with mental health conditions, learning disabilities, specific cultural needs, and language barriers.[161]

Exploring the differences in long COVID symptom profiles across ethnic groups among HCWs is important for several reasons: first, disparities in COVID-19 outcomes have been observed among different ethnic groups, which may be due to factors such as socioeconomic status and pre-existing health conditions; second, understanding how symptom profiles and trajectories of long COVID vary across diverse ethnic backgrounds is essential for addressing these health inequities. Additionally, identifying the underlying mechanisms causing long COVID is a key priority, as this would enable early management of organ complications and prevent long-term symptoms and serious adverse consequences. This, in turn, could help individuals affected by long COVID to return to their normal lives as soon as possible.

Comprehensive studies comparing long COVID symptom profiles among HCWs with different ethnic backgrounds in the UK are still lacking. Addressing this gap in the literature is important for developing targeted interventions and support for HCWs suffering from these symptoms.
In this research, we explored new factors—such as vaccination status, the severity of acute COVID-19 illness, and the type of COVID-19 variant—that were not available during the baseline phase. Therefore, this analysis is not simply an update but adds valuable new dimensions by comparing different variables and assessing how the risk factors for long COVID have evolved over time. As a secondary analysis, we were interested in determining factors associated with long COVID symptom groups in those with a history of SARS-CoV-2 infection. We were also interested in the association of ethnicity and other demographic and occupational factors with experiencing long COVID groups of symptoms.

5.2 Methods

5.2.1 Study design

This analysis was based on questionnaire data from the third questionnaire (administered between October 2021 and November 2021) and the fourth questionnaire (administered between June 2022 and October 2022) of the UK-REACH longitudinal cohort study, as shown in **Figure 5.1.** We combined data from the third and fourth questionnaires to provide sufficient numbers for the analysis, where data from the third questionnaire were prioritised to reduce recall bias, as it was closer to the event of having COVID-19, ensuring more accurate reporting of symptom duration and severity; however, if missing, data from the fourth questionnaire were used where available.

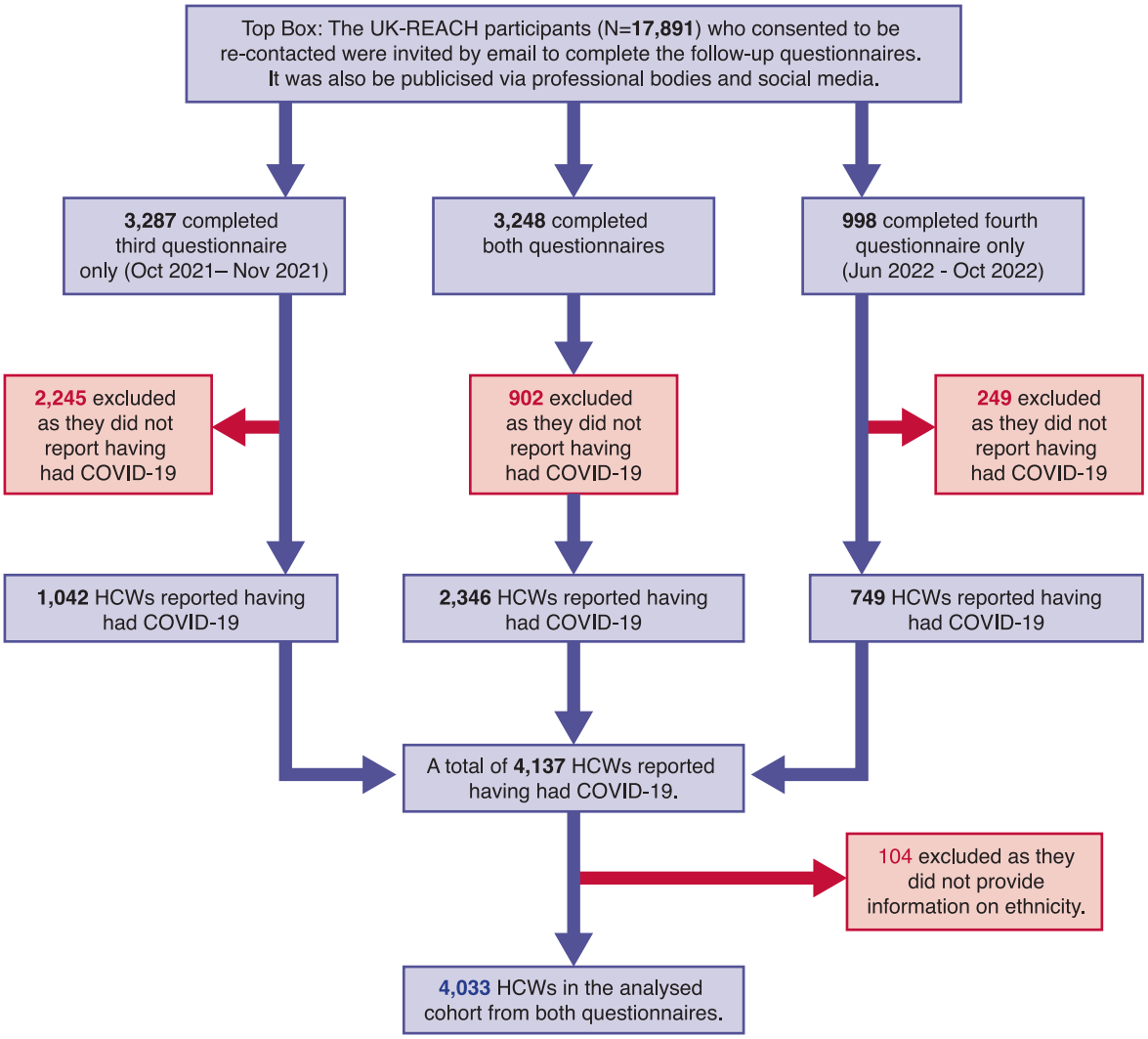
5.2.2 Participants and sampling strategy

The recruitment process for participants was consistent with that of previous questionnaires, ensuring fixed measures of variables over time to support potential future longitudinal analysis. This is explained in detail in UK-REACH study protocol,[112] previous publications.[113,162]

Figure 5.1 illustrates the recruitment and formation of the analysed cohort. In summary, the UK-REACH study involved 17,891 participants who consented to follow-up questionnaires and were recontacted via emailing professional bodies and social media. Initially, 6,535 participants completed the third questionnaire between October 2021 and November 2021, and 4,246 participants completed the fourth questionnaire between June 2022 and October 2022. Among these, 3,248 participants completed both questionnaires. In total, 4,137 HCWs reported having had COVID-19, but 104 were excluded for not providing ethnicity information. This resulted in a final cohort of 4,033 HCWs who reported having had COVID-19, forming the analysis sample (**Figure 5.1**).

The sample was restricted to participants who self-reported having had or currently having COVID-19. Participants' history of SARS-CoV-2 was derived from answers to the question "Do you think that you currently have or have had COVID-19?". Those who answered "Yes, my own suspicions", "Yes, suspected by a doctor but not tested" or "Yes, confirmed by a positive test" were considered to have had COVID-19. Those who answered "no" were considered not to have had COVID-19.

Figure 5.1. Formation of the analysed cohort



HCW – Healthcare worker (those in professional healthcare roles or ancillary workers in a healthcare setting or registered with one of the seven participating UK healthcare professional regulatory bodies – see methods for a list of participating regulatory bodies).

Outcome measures

Long COVID definition

Our primary outcome was long COVID as a binary measure of presence or absence of long COVID. Long COVID was defined as symptoms that persisted for ≥12 weeks following a SARS-CoV-2 infection to align with NICE definition of long COVID.[163] We derived the long COVID variable using data from questionnaires 3 and 4 and based on symptom duration.

- A participant was considered to have long COVID based on questionnaire 3 if they reported only one instance of COVID-19 and any symptoms lasting ≥ 12 weeks. This approach ensures information about COVID-19 is closest to the event. If this information was missing in questionnaire 3, it was taken from questionnaire 4. If a participant reported more than one episode of COVID-19, the information was taken from questionnaire 4 to use the most recent data.
- A participant was considered not to have long COVID if they reported no symptoms lasting ≥ 12 weeks in both questionnaires 3 and 4.

Grouping of long COVID symptoms

Our secondary outcome was the presence or absence of long COVID symptom groups. I derived the groups as follows: both questionnaires included 32 symptoms of COVID-19. Three of these were free-text responses for "other" symptoms to be reported by participants and were excluded in this analysis. Among the remaining 29 symptoms, one symptom (skin rash) had few participants reporting it (n=3) and was thus excluded from the analysis due to insufficient cases to undertake an adjusted analysis with skin rash as an outcome. We grouped the remaining 28 symptoms into seven groups based on existing previous literature:3,164,165 Cardiopulmonary, Gastrointestinal, Musculoskeletal, Neurocognitive and Neurologic, Upper Respiratory Tract, Psychological and Social, and Systemic, as shown in **Table 5.1.**

Table 5.1. Grouping of long COVID symptoms

Cardiopulmonary	Gastrointestinal	Musculoskeletal	Neurocognitive and Neurologic	Upper Respiratory Tract	Psychological and Social	Systemic
Cough - dry	Nausea / vomiting	Muscle or body aches	Difficulty concentrating	Runny nose or nasal congestion	Feeling anxious	Chills or shivering
Cough - productive of mucus or phlegm	Diarrhoea	Joint pain	Memory loss or 'confusion	Sore throat	Feeling depressed	Fever
Shortness of breath	Abdominal pain		Tinnitus (ringing or noises in ears)	Sneezing	Difficulty sleeping	Reduced appetite
Chest pain or tightness			Pins and needles or numbness			Fatigue
Palpitations			Headache			Dizziness
Loss or change in sense of smell						
Loss or change in sense of taste						

5.2.3 Exposure

Our primary exposure of interest was self-reported ethnicity, which was classified as explained in the introduction of this report.

5.2.4 Covariates

We selected the following covariates for inclusion in the analysis as they potentially confound the relationship between the exposures of interest and the outcome:

- Demographic characteristics (age, sex, migration status).
- Job role (categorised into: (1) Doctor or medical support, (2) Nurse, NA or Midwife, (3) Allied Health Professional (which also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles), (4) Dental, and (5) Admin, estates or other).
- Clinical factors (number of COVID vaccines at the time of acute infection, categorised as 0, 1, 2, or 3 doses; the type of COVID variant, categorised as 1 “Wuhan”, 2 “Alpha”, 3 “Delta”, 4 “Omicron BA.1”, and 5 “Later Omicron subvariant” according to Our World in Data;[166] and the severity of acute COVID-19 infection, categorised as 1 “not bedridden”, 2 “bedridden 1–3 days”, 3 “bedridden 3–6 days”, or 4 “bedridden 7 days or longer”).167
- Household/residential/social factors (index of multiple deprivation [IMD, the official measure of relative deprivation for small areas of England, expressed as quintiles]).[157]
- BMI in kg/m2 categorised as follows: (1) BMI < 25, (2) BMI ≥ 25 and < 30, (3) BMI ≥ 30 and < 40, and (4) BMI ≥ 40.
- Self-reported comorbidities (any of the following: diabetes (type 1 or 2), asthma, other lung conditions (e.g., chronic obstructive pulmonary disease (COPD), bronchitis and emphysema), depression, anxiety, other cardiovascular diseases (CVDs) which included heart diseases/problems, strokes, Hypertension).

Supplementary material 6 contains a description of each variable, which questionnaire(s) it was measured in, and how it was derived (if applicable).

5.2.5 Statistical analysis

We summarised categorical variables as frequency and percentage, and non-normally distributed continuous variables as median average and IQR. We compared long COVID symptoms groups between ethnic groups using chi-square tests as they were categorical variables. We used univariable and multivariable logistic regression to determine unadjusted and adjusted associations of the variables described above with long COVID and its groups and reported results as ORs and aORs with 95% CIs.

We reported frequency and percentage of observations with missing data for each variable of interest.

To investigate the extent to which differences in long COVID risk by ethnic group could be explained by other related risk factors, we generated a base logistic regression model (i.e., the minimally adjusted model) in which we adjusted for minimum basic demographic variables that are confounders (i.e., age, sex, migration status, occupation). We then included mediators as additional variables into this base model which I called "Fully-adjusted model" which included the same variables included in the fully adjusted model for the baseline analysis (i.e., age, sex, migration status, occupation, IMD, self-reported comorbidities, BMI) for easier comparison in addition to vaccination status.

We conducted all analyses and multiple imputation using Stata 18 (StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.).[168]

We excluded those with missing data for the primary exposure and outcome of interest from all analyses.

We used multiple imputation by chained equations to impute missing data in logistic regression models [158] using all variables, including the outcome measure.

Although indices of deprivation are available for UK countries outside England (i.e., Scotland, Wales, Northern Ireland), it is recognised that these are not directly comparable with English IMD. It was therefore decided to code IMD as missing for those outside England and impute the missing information.

We conducted a sensitivity analysis using only observations with complete data in all covariates for the fully adjusted model for the univariable analysis, fully adjusted, and minimally adjusted models to see if there are any differences in the results from the primary analysis.

5.3 Results

5.3.1 Description of the analysed cohort

A description of the analysed cohort (N=4,033) is shown in **Table 5.2.**

The majority of participants (69.4%) were females, and the median age was 45 years (IQR: 35 – 55); 24.7% of the cohort were from an ethnic minority group (16.1% Asian, 3.8% Mixed, 3.3% Black, and 1.5% Other); 21.5% were born outside the UK. The largest occupational group was AHPs (38.4%) followed by nursing roles (20.3%) and doctors or medical support staff (20.1%), with 5.1% in dental roles and 5.0% in administrative or other roles. Nearly a quarter (23.5%) lived in the least deprived postcode quintile and 7.7% in the most deprived quintile.

The most common comorbidities were anxiety (14.7%), asthma (10.5%), depression (10.3%) and other cardiovascular diseases (9.1%). Among the participants, 39.1% had a BMI under 25, potentially including underweight individuals, while 22.7% were classified as overweight (BMI 25-30), 13.3% as obese (BMI 30-40), and 2% as morbidly obese (BMI ≥ 40). Notably, a combined total of 38% of participants fell into the overweight, obese, or morbidly obese categories. The majority of the cohort had been bedridden with acute COVID-19 for 1-3 days (29.8%) or 4-6 days (16.8%); 23.8% were not bedridden; and 17.4% were bedridden for 7 days or longer. At the time of the reported acute infection, 37.5% had received no COVID-19 vaccines, 4% had had one dose, 8.8% two doses, and 37.5% three doses. The most common variants participants were likely to be infected with were Wuhan (39.7%) and the Later Omicron subvariant (24%).

Table 5.2. Description of the analysed cohort

Variable	Analysed cohort Those who were infected with COVID-19 N=4,033
Ethnicity	
White	3,038 (75.3%)
Asian	648 (16.1%)
Black	133 (3.3%)
Mixed	153 (3.8%)
Other	61 (1.5%)
Missing	0 (0.0%)
Migration Status	
Born in UK	3,160 (78.4%)
Born abroad	868 (21.5%)
Missing	5 (0.1%)
Age, median (IQR)	45 (35 – 55)
Missing	396 (9.8%)
Sex	
Male	847 (21.0%)
Female	2,798 (69.4%)
Missing	388 (9.6%)
No. of COVID vaccines at time of acute infection	
0	1,512 (37.5%)
1	162 (4.0%)
2	353 (8.8%)
3	1,511 (37.5%)
Missing	495 (12.3%)
Type of COVID variant	
Wuhan	1,600 (39.7%)
Alpha	242 (6.0%)
Delta	559 (13.9%)
Omicron BA.1	417 (10.3%)
Later Omicron subvariant	966 (24.0%)
Missing	249 (6.2%)

Severity of acute COVID-19 infection	
Not bed or sofa bound	960 (23.8%)
In bed or on sofa for 1-3 days	1,200 (29.8%)
In bed or on sofa for 4-6 days	677 (16.8%)
In bed or on sofa 7 days or longer	703 (17.4%)
Missing	493 (12.2%)
Index of multiple deprivation quintile	
1 (most deprived)	312 (7.7%)
2	522 (12.9%)
3	671 (16.6%)
4	785 (19.5%)
5 (least deprived)	946 (23.5%)
Missing	797 (19.8%)
Comorbidities	
Not diabetic	3,197 (79.3%)
Diabetic	112 (2.8%)
Missing	724 (18.0%)
Comorbidities	
No depression	2,906 (72.1%)
Depression	416 (10.3%)
Missing	711 (17.6%)
Comorbidities	
No anxiety	2,740 (67.9%)
Anxiety	592 (14.7%)
Missing	701 (17.4%)
Comorbidities	
Not asthmatic	2,886 (71.6%)
Asthmatic	425 (10.5%)
Missing	722 (17.9%)
Comorbidities	
No other lung conditions	3,279 (81.3%)
Other lung conditions	31 (0.8%)
Missing	723 (17.9%)
Comorbidities	
No other CVDs [a]	3,638 (90.2%)
Other CVDs	365 (9.1%)
Missing	30 (0.74%)
Body Mass Index	
<25	1,577 (39.1%)
³ 25 & <30	916 (22.7%)
³ 30 & <40	536 (13.3%)
³ 40	80 (2.0%)
Missing	924 (22.9%)

Occupation	
Doctor or medical support	811 (20.1%)
Nurse, NA or Midwife	817 (20.3%)
Allied Health Professional*	1,550 (38.4%)
Dental	207 (5.1%)
Admin, estates or other	203 (5.0%)
Missing	445 (11.0%)

**Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*
95% CI: 95% confidence interval
[a] heart diseases, heart problem, stroke, HTN
OR: odds ratio
Ref: reference category for categorical variables

5.3.2 Prevalence of long COVID

Over a quarter of the sample (26.5%; 1,067/4,033) had experienced long COVID. **Table 5.3** presents the characteristics and distribution of covariates in the cohort. 18.3% (196) of those who experienced long COVID were from ethnic minority groups compared with 26.8% (799) who did not experience long COVID. Amongst those who reported long COVID, 19.0% were born abroad compared with 22.4% amongst those who did not report long COVID.

16.5% of those reporting long COVID had received three doses of a COVID-19 vaccine compared with 45.0% who did not experience long COVID. Regarding the type of COVID variant, the majority (60.7%) of those who experienced long COVID were infected with the Wuhan variant compared with 32.1% who did not experience long COVID.

Table 5.3. Characteristics and distribution of the variables in the cohort

Variable	Analysed cohort Those who were infected with COVID-19 N=4,033	
Ethnicity		
White	2,167 (73.1%)	871 (81.6%)
Asian	523 (17.6%)	125 (11.7%)
Black	108 (3.6%)	25 (2.3%)
Mixed	117 (3.94%)	36 (3.4%)
Other	51 (1.72%)	10 (0.9%)
Missing	0 (0.0%)	0 (0.0%)
Migration Status		
Born in UK	2,298 (77.5%)	862 (80.8%)
Born abroad	665 (22.4%)	203 (19.0%)
Missing	3 (0.1%)	2 (0.2%)
Age, median (IQR)	44 (35 – 54)	49 (38 – 55)
Missing	296 (10.0%)	100 (9.4%)
Sex		
Male	674 (22.7%)	173 (16.2%)
Female	2,001 (67.5%)	979 (74.7%)
Missing	291 (9.8%)	97 (9.1%)

No. of COVID vaccines at time of acute infection		
0	909 (30.7%)	603 (56.5%)
1	115 (3.9%)	47 (4.4%)
2	278 (9.4%)	75 (7.0%)
3	1,335 (45.0%)	176 (16.5%)
Missing	329 (11.1%)	166 (15.6%)
Type of COVID variant		
Wuhan	952 (32.1%)	648 (60.7%)
Alpha	160 (5.4%)	82 (7.7%)
Delta	438 (14.8%)	121 (11.3%)
Omicron BA.1	354 (11.9%)	63 (5.9%)
Later Omicron subvariant	882 (29.7%)	84 (7.9%)
Missing	180 (6.1%)	69 (6.5%)
Severity of acute COVID-19 infection		
Not bed or sofa bound	846 (28.5%)	114 (10.7%)
In bed or on sofa for 1-3 days	980 (33.0%)	220 (20.6%)
In bed or on sofa for 4-6 days	459 (15.5%)	218 (20.4%)
In bed or on sofa 7 days or longer	265 (8.9%)	438 (41.1%)
Missing	416 (14.0%)	77 (7.2%)
Index of multiple deprivation quintile		
1 (most deprived)	225 (7.6%)	87 (8.2%)
2	393 (13.3%)	129 (12.1%)
3	482 (16.3%)	189 (17.7%)
4	586 (19.8%)	199 (18.7%)
5 (least deprived)	699 (23.6%)	247 (23.2%)
Missing	581 (19.6%)	216 (20.2%)
Comorbidities		
Not diabetic	2,363 (79.7%)	834 (78.2%)
Diabetic	78 (2.6%)	34 (3.2%)
Missing	525 (17.7%)	199 (18.7%)
Comorbidities		
No depression	2,198 (74.1%)	708 (66.4%)
Depression	250 (8.4%)	166 (15.6%)
Missing	518 (17.5%)	193 (18.1%)
Comorbidities		
No anxiety	2,095 (70.6%)	645 (60.5%)
Anxiety	361 (12.2%)	231 (21.7%)
Missing	510 (17.2%)	191 (17.9%)
Comorbidities		
Not asthmatic	2,184 (73.6%)	702 (65.8%)
Asthmatic	259 (8.7%)	166 (15.6%)
Missing	523 (17.6%)	199 (18.7%)
Comorbidities		
No other lung conditions	2,432 (82.0%)	847 (79.4%)
Other lung conditions	9 (0.3%)	22 (2.1%)
Missing	525 (17.7%)	198 (18.7%)
Comorbidities		
No other CVDs a	2,705 (91.2%)	933 (87.4%)
Other CVDs	240 (8.1%)	125 (11.7%)
Missing	21 (0.7%)	9 (0.8%)

Body Mass Index		
<25	1,226 (41.3%)	351 (32.9%)
³ 25 & <30	666 (22.5%)	250 (23.4%)
³ 30 & <40	362 (12.2%)	174 (16.3%)
³ 40	43 (1.5%)	37 (3.5%)
Missing	669 (22.6%)	255 (23.9%)
Occupation		
Doctor or medical support	668 (22.5%)	143 (13.4%)
Nurse, NA or Midwife	535 (18.0%)	282 (26.4%)
Allied Health Professional*	1,132 (38.2%)	418 (39.2%)
Dental	157 (5.3%)	50 (4.7%)
Admin, estates or other	137 (4.8%)	66 (6.2%)
Missing		331 (11.4%)

[a] *heart diseases, heart problem, stroke, HTN*

**Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*

5.3.3 Symptom patterns and differences among HCWs with long COVID and without long COVID

Figure 5.2 presents symptoms patterns differences among HCWs with and without long COVID. Overall, there is a greater prevalence of symptoms reported by HCWs with long COVID compared to those without long COVID. This is particularly apparent in systemic symptoms such as fatigue, neurologic symptoms including pins and needles or numbness, difficulty sleeping, difficulty concentrating, and memory loss or confusion. Additionally, there is a higher reporting of psychological symptoms, such as depression and anxiety, among those with long COVID compared to those without long COVID.

Figure 5.2. Symptoms Patterns Differences among HCWs with Long COVID and Without

5.3.4 Groups of long COVID symptoms and differences by ethnicity

The most common symptom groups were neurocognitive and neurologic (63.4%), cardiopulmonary (with the highest prevalence among Asian HCWs at 45.6%), systemic (54.4%, particularly affecting Black and Mixed ethnicities at 64.0% and 63.9%, respectively), and musculoskeletal (23.1%, with the highest prevalence among Mixed ethnicity at 30.6%.

Table 5.4 presents the distribution of symptom groups by ethnicity.

Table 5.4. Description of the analysed cohort stratified by ethnicity

Long COVID symptom groups	Long COVID cohort N=1,067					
	White	Asian	Black	Mixed	Other	P-value
Long COVID cohort N=1,067	871 (81.6%)	125 (11.7%)	25 (2.3%)	36 (3.4%)	10 (0.9%)	-
No Cardiopulmonary	532 (61.1%)	68 (54.4%)	14 (56.0%)	20 (55.7%)	6 (60.0%)	0.641
Cardiopulmonary	339 (38.9%)	57 (45.6%)	11 (44.0%)	16 (44.4%)	4 (40.0%)	
No Gastrointestinal	815 (93.6%)	120 (96.0%)	25 (100.0%)	32 (88.9%)	10 (100.0%)	0.289
Gastrointestinal	56 (6.4%)	5 (4.0%)	0 (0.0%)	4 (11.1%)	0 (0.0%)	
No Musculoskeletal	671 (77.0%)	97 (77.6%)	20 (80.0%)	25 (69.4%)	8 (80.0%)	0.851
Musculoskeletal	200 (23.0%)	28 (22.4%)	5 (20.0%)	11 (30.6%)	2 (20.0%)	
No Neurocognitive and Neurologic	313 (35.9%)	50 (40.0%)	13 (52.0%)	12 (33.3%)	3 (30.0%)	0.449
Neurocognitive and Neurologic	558 (64.1%)	75 (60.0%)	12 (48.0%)	24 (66.7%)	7 (70.0%)	
No Psychological and Social	596 (68.4%)	77 (61.6%)	19 (76.0%)	24 (66.7%)	8 (80.0%)	0.843
Psychological and Social	275 (31.6%)	48 (38.4%)	6 (24.0%)	12 (33.3%)	2 (20.0%)	
No systemic	406 (46.6%)	53 (42.4%)	9 (36.0%)	13 (36.1%)	6 (60.0%)	0.413
Systemic	465 (53.4%)	72 (57.6%)	16 (64.0%)	23 (63.9%)	4 (40.0%)	
No Upper Respiratory Tract	804 (92.3%)	115 (92.0%)	23 (92.0%)	31 (86.1%)	10 (100.0%)	0.610
Upper Respiratory Tract	67 (7.7%)	10 (8.0%)	2 (8.0%)	5 (13.9%)	0 (0.0%)	

5.3.5 Univariable analysis of risk factors for long COVID

Table 5.5 presents the unadjusted ORs for the association of covariates with long COVID.

Demographic risk factors

The odds of HCWs of Black ethnicity (OR 0.58, 95% CI 0.37 – 0.90, p=0.014), Asian ethnicity (OR 0.59, 95% CI 0.48 – 0.73, p<0.001), or o Other ethnicity (OR 0.49, 95% CI 0.25 – 0.97, p=0.039) experiencing long COVID were lower than for HCWs of White ethnicity.

Compared to HCWs born in the UK, HCWs who were born abroad had lower odds of reporting long COVID (OR 0.81, 95% CI 0.68 – 0.97, p=0.021). Compared to HCW participants who did not have long COVID, participants with long COVID were more likely to be older (OR 1.17, 95% CI 1.10 – 1.25, p<0.001, per decade increase in age), and emale (OR 1.55, 95% CI 1.29 – 1.87, p<0.001, compared to males). There was no significant dierence in the odds o experiencing long COVID by IMD quintile.

Clinical risk factors

The number of COVID vaccines received at the time of acute infection was inversely associated with the odds of experiencing long COVID, with those having three doses being much less likely than unvaccinated individuals to report long COVID (OR 0.20, 95% CI 0.16 – 0.24, p<0.001).

Compared to those who were infected with the Wuhan variant, individuals who were infected with the Alpha variant had lower odds of reporting long COVID (OR 0.75, 95% CI 0.57 – 1.00, p=0.050).

The odds of experiencing long COVID were significantly higher among those who had a more severe acute COVID-19 infection compared with those with mild acute COVID-19 infection. Particularly, individuals who were bedridden or on the sofa for 1-3 days had higher odds (OR 1.67, 95% CI 1.31 – 2.13, p<0.001) compared with those not bedridden or sofa bound. The odds were even higher for those bedridden or sofa bound for 4-6 days (OR 3.52, 95% CI 2.74 – 4.54, p<0.001) and those bedridden or sofa bound for 7 days or longer (OR 12.27, 95% CI 9.57 – 15.72, p<0.001).

Health risk factors

HCWs with the self-reported comorbidities of depression, anxiety, other CVDs, asthma and/or other lung conditions were more likely to experience long COVID compared with those who did not report having these conditions. The odds of experiencing long COVID increased as BMI increased compared to a BMI of <25.

Occupational risk factors

Compared with those in a medical role, those in all other roles had higher odds of long COVID.

Table 5.5. Univariate analysis for the unadjusted odds ratios for the association of covariates with long COVID

	Total N=4,033	
Variable	Unadjusted OR (95% CI)	P-value
Ethnicity		
White	Ref	-
Asian	0.59 (0.48 – 0.73)	<0.001
Black	0.58 (0.37 – 0.90)	0.014
Mixed	0.77 (0.52 – 1.1)	0.170
Other	0.49 (0.25 – 0.97)	0.039
Migration Status		
Born in UK	Ref	-
Born abroad	0.81 (0.68 – 0.97)	0.021
Age, per decade increase	1.17 (1.10 – 1.25)	<0.001
Sex		
Male	Ref	-
Female	1.55 (1.29 – 1.87)	<0.001
No. of COVID vaccines at time of acute infection		
0	Ref	-
1	0.62 (0.43 – 0.88)	0.007
2	0.41 (0.31 – 0.54)	<0.001
3	0.20 (0.16 – 0.24)	<0.001
Type of COVID variant		
Wuhan	Ref	-
Alpha	0.75 (0.57 – 1.00)	0.050
Delta	0.41 (0.32 – 0.51)	<0.001
Omicron BA.1	0.26 (0.20 – 0.35)	<0.001
Later Omicron subvariant	0.14 (0.10 – 0.18)	<0.001
Severity of acute COVID-19 infection		
Not bed or sofa bound	Ref	-
In bed or on sofa for 1-3 days	1.67 (1.31 – 2.13)	<0.001
In bed or on sofa for 4-6 days	3.52 (2.74 – 4.54)	<0.001
In bed or on sofa 7 days or longer	12.27 (9.57 – 15.72)	<0.001
Index of multiple deprivation quintile		
1 (most deprived)	Ref	-
2	0.85 (0.62 – 1.17)	0.312
3	1.01 (0.75 – 1.37)	0.927
4	0.88 (0.65 – 1.18)	0.389
5 (least deprived)	0.91 (0.69 – 1.22)	0.538
Comorbidities		
Not diabetic	Ref	-
Diabetic	1.07 (0.92 – 1.24)	0.370
Comorbidities		
No depression	Ref	-
Depression	2.24 (2.10 – 2.41)	<0.001
Comorbidities		
No anxiety	Ref	-
Anxiety	2.04 (2.29 – 2.60)	<0.001

Comorbidities		
No other CVDs[a]	Ref	-
Other CVDs	1.17 (1.06 – 1.28)	0.001
Comorbidities		
Not asthmatic	Ref	-
Asthmatic	1.99 (1.85 – 2.14)	<0.001
Comorbidities		
No other lung conditions	Ref	-
Other lung conditions	7.44 (6.10 – 9.07)	<0.001
Body Mass Index		
<25	Ref	-
≥25 & <30	1.31 (1.09 – 1.58)	0.005
≥30 & <40	1.68 (1.35 – 2.08)	<0.001
≥40	3.01 (1.91 – 4.74)	<0.001
Occupation		
Doctor or medical support	Ref	-
Nurse, NA or Midwife	2.47 (1.96 – 3.11)	<0.001
Allied Health Professional*	1.73 (1.40 – 2.15)	<0.001
Dental	1.46 (1.01 – 2.11)	0.043
Admin, estates or other	2.20 (1.57 – 3.11)	<0.001

95% CI: 95% confidence interval
OR: odds ratio
Ref: reference category for categorical variables
[a] *heart diseases, heart problem, stroke, HTN*
**Also includes pharmacists, healthcare scientists, ambulance workers and those in optical roles*

5.3.6 Univariable analysis of ethnicity for long COVID symptoms groups

Table 5.6 presents the unadjusted ORs for the association of ethnicity with experiencing long COVID symptoms. Although, there were no significant differences in risk of experiencing particular symptoms groups by ethnic group, some trends can be observed. For example, Asian HCW have slightly higher odds o experiencing cardiopulmonary symptoms (OR: 1.32, 95% CI 0.90-1.92, p=0.128) and systemic symptoms (OR: 1.55, 95% CI 0.68-3.55, p=0.298) compared with White HCWs. Black HCWs had lower odds of experiencing gastrointestinal symptoms (OR: 0.54, 95% CI 0.24-1.23, p=0.508) but higher o psychological and social symptoms (OR: 1.08, 95% CI 0.53-2.20, p=0.824) than their White counterparts. HCWs from Mixed ethnicity show higher odds of experiencing musculoskeletal symptoms (OR: 1.48, 95% CI 0.71-3.05, p=0.293) and neurological symptoms (OR: 1.12, 95% CI 0.55-2.27, p=0.750) compared to White HCWs.

5.3.7 Multivariable analysis of risk factors for long COVID

Figure 5.3 shows multivariable logistic regression models (both minimally adjusted and fully adjusted) demonstrating the covariates associated with long COVID.

Association of ethnicity with long COVID risk

In the minimally adjusted model, HCWs from Asian ethnicity were at lower risk of experiencing long COVID (aOR 0.77, 95% CI 0.60 – 0.98, p=0.035) compared with the White group, while in the fully adjusted model, HCWs from Black ethnic backgrounds were at lower risk of experiencing long COVID (aOR 0.57, 95% CI 0.34 – 0.94, p=0.027). There were no significant differences in risk of long COVID by other ethnic groups.

Association of other factors with long COVID risk

In the minimally adjusted model, older age increased risk of long COVID, (aOR 1.15, 95% CI 1.08 – 1.23, p < 0.001), as did being female (aOR 1.34, 95% CI 1.10 – 1.65, p=0.004) and being in a nursing (aOR 2.02, 95% CI 1.55 – 2.62, p < 0.001), AHPs (aOR 1.56, 95% CI 1.24 – 1.97, p < 0.001), and admin, estates or Other role (aOR 2.02, 95% CI 1.43 – 2.85, p < 0.001) compared with HCWs in medical roles.

In the fully adjusted model, age remained a significant risk factor with each decade increase in age leading to higher odds of experiencing long COVID (aOR 1.27, 95% CI 1.17 – 1.37, p < 0.001), as did being female (aOR 1.48, 95% CI 1.18 – 1.85, p=0.001).

Being vaccinated at the time of acute COVID infection was associated with progressively lower odds of experiencing long COVID as the number of vaccine doses increased: one dose (aOR 0.66, 95% CI 0.45 – 0.96, p=0.030); two doses (aOR 0.42, 95% CI 0.32 – 0.56, p<0.001); and three doses (aOR 0.17, 95% CI 0.14 – 0.21, p<0.001).

Self-reported anxiety (aOR 1.85, 95% CI 1.40 – 2.45, p < 0.001) and other CVDs (aOR 1.33, 95% CI 1.01 – 1.75, p= 0.042) were associated with an elevated risk of long COVID (Figure 5.3). Self-reported asthma (aOR 1.89, 95% CI 1.49 – 2.37, p < 0.001) and other lung conditions (aOR 4.42, 95% CI 1.94 – 10.04, p < 0.001) were also significant risk factors. Having a BMI of ≥30 and <40, as well as a BMI of ≥40, were associated with significantly higher odds of experiencing long COVID compared with a normal BMI (aOR 1.32, 95% CI 1.03–1.70, p = 0.028; aOR 1.93, 95% CI 1.13–3.28, p = 0.016, respectively). In terms of occupation, all job roles (nursing, AHPs, dental, admin, estates and other) were at higher odds of experiencing long COVID than HCWs in medical roles **(Figure 5.3).**

5.3.8 Multivariate analysis of ethnicity and other factors for long COVID symptoms groups

Figures (5.4 – 5.10) show multiple logistic regression demonstrating the factors associated with each of the long COVID groups for HCWs with a history of long COVID.

Minimally adjusted Model

On multivariable analysis in a minimally adjusted model where we adjusted for basic demographics such as age, sex, migration status, and occupation, we found that HCWs from Asian ethnicity were at higher odds of experiencing cardiopulmonary symptoms (aOR: 1.58, 95% CI 1.02 – 2.45, p=0.039). Female HCWs were more likely to experience gastrointestinal symptoms (aOR: 3.74, 95% CI 1.14 – 12.32, p=0.030). HCWs who are in nursing and dental roles were more likely to experience musculoskeletal symptoms, while female HCWs and AHPs were more likely to experience neurocognitive and neurologic symptoms. HCWs in nursing roles were also more likely to experience psychological and social as well as systemic symptoms, and those born abroad were more likely to experience upper respiratory tract symptoms (aOR: 1.93, 95% CI 1.08 – 3.44, p=0.026) as shown in **Figures (5.4 – 5.10).**

Fully adjusted Model

On multivariable analysis in a fully adjusted model **(see Figures 5.4 – 5.10),** we found that for cardiopulmonary symptoms, HCWs of Asian ethnicity were more likely to be ected (aOR: 1.62, 95% CI 1.04 – 2.51, p=0.032), while having two or three doses of the vaccine was associated with a lower likelihood of experiencing these symptoms. Female HCWs were almost four times more likely to experience gastrointestinal symptoms compared with males (aOR: 3.78, 95% CI 1.14 – 12.45, p=0.029). For musculoskeletal symptoms, those in nursing roles (aOR: 2.50, 95% CI 1.32 – 4.72, p=0.005), AHPs (aOR: 1.82, 95% CI 1.01 – 3.30, p=0.048), and dental roles (aOR: 3.07, 95% CI 1.31 – 7.17, p=0.010) were more likely to be affected than those in medical roles, whereas having three doses of the vaccine was associated with a reduced likelihood compared with those who did not recive any doses. Neurocognitive and neurologic symptoms were more likely in emale HCWs (aOR: 1.58, 95% CI 1.10 – 2.28, p=0.014) and AHPs (aOR: 1.58, 95% CI 1.05 – 2.39, p=0.029), with two or three vaccine doses being associated with a lower likelihood of experiencing these symptoms. Similar to the minimally adjusted model, nursing roles were more likely to experience psychological and social symptoms, and systemic symptoms, compared with HCWs in medical roles. Older age was also a significant risk actor or systemic symptoms. Lastly, HCWs who were born abroad were more likely to experience upper respiratory tract symptoms compared with HCWs born in the UK as shown in Figures **(5.4 – 5.10).**

5.3.9 Sensitivity analyses

We analysed the observations with complete data in all covariates for the univariable analysis, fully adjusted, and minimally adjusted models, which did not significantly alter interpretation o the results o the primary analysis (i.e., the significant predictors remained the same).

Table 5.6. The Unadjusted ORs for the association of ethnicity with experiencing long COVID symptoms.

	Total N=1,067													
	Cardiopulmonary		Gastrointestinal		Musculoskeletal		Neurocognitive & Neurologic		Psychological & Social		Upper Respiratory Tract		Systemic	
Variable	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Unadjusted OR (95% CI)	P-value
Ethnicity														
White	Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Asian	1.32 (0.90 - 1.92)	0.154	0.61 (0.24 - 1.54)	0.294	0.97 (0.62 - 1.52)	0.889	0.84 (0.57 - 1.23)	0.378	1.35 (0.92 - 1.99)	0.128	1.04 (0.52 - 2.09)	0.904	1.19 (0.81 - 1.73)	0.377
Black	1.23 (0.55 - 2.75)	0.608	-	-	0.84 (0.31 - 2.26)	0.728	0.52 (0.23 - 1.15)	0.105	0.68 (0.27 - 1.73)	0.424	1.04 (0.24 - 4.52)	0.955	1.55 (0.68 - 3.55)	0.298
Mixed	1.26 (0.64 - 2.46)	0.507	1.82 (0.62 - 5.33)	0.275	1.48 (0.71 - 3.05)	0.293	1.12 (0.55 - 2.27)	0.75	1.08 (0.53 - 2.20)	0.824	1.94 (0.73 - 5.14)	0.185	1.54 (0.77 - 3.09)	0.219
Other	1.05 (0.29 - 3.73)	0.945	-	-	0.84 (0.18 - 3.98)	0.825	1.31 (0.34 - 5.10)	0.698	0.54 (0.11 - 2.57)	0.44	-	-	0.58 (0.16 - 2.08)	0.404

Figure 5.3. Multivariable Logistic Regression for the Factors Associated with Long COVID for HCWs with a History of SARS-CoV-2 Infection (minimally- and fully- adjusted models)

Figure 5.4. Multivariate logistic regression demonstrating the factors associated with Cardiopulmonary symptoms for HCWs with a history of SARS-CoV-2-infcetion)

Figure 5.5. Multivariate logistic regression demonstrating the factors associated with Gastrointestinal symptoms for HCWs with a history of SARS-CoV-2-infcetion

Figure 5.6. Multivariate logistic regression demonstrating the factors associated with Musculoskeletal symptoms for HCWs with a history of SARS-CoV-2-infcetion

Figure 5.7. Multivariate logistic regression demonstrating the factors associated with Neurocognitive & Neurologic symptoms for HCWs with a history of SARS-CoV-2-infcetion

Figure 5.8. Multivariate logistic regression demonstrating the factors associated with Psychological & Social symptoms for HCWs with a history of SARS-CoV-2-infcetion

Figure 5.9. Multivariate logistic regression demonstrating the factors associated with Systemic symptoms for HCWs with a history of SARS-CoV-2-infcetion

Figure 5.10. Multivariate logistic regression demonstrating the factors associated with Upper Respiratory Tract symptoms for HCWs with a history of SARS-CoV-2-infcetion

5.4 Summary

We employed a cross-sectional analysis to analyse responses from 4,033 HCWs with a history of SARS-CoV-2 infection, in which we found that 26.5% experienced long COVID. Statistically significant risk factors for the development of long COVID identified included older age, female sex, specific occupational roles (especially nursing and AHPs), and the severity of acute SARS-CoV-2 infection. The association between ethnicity and the risk of long COVID in this chapter showed significant variability when unadjusted, minimally adjusted, and fully adjusted models were considered. Vaccination showed a reduced risk of long COVID, with higher doses correlating with reduced long COVID risk. Additionally, the study highlighted variations in symptom groups across different ethnic, occupational and other demographic factors.

Cardiopulmonary symptoms were more prevalent among HCWs of Asian ethnicity, while vaccination with two or more doses was associated with lower odds of these symptoms. Female HCWs had significantly higher odds of experiencing gastrointestinal symptoms. Musculoskeletal symptoms were more common among HCWs in nursing, AHP, and dental roles, though three vaccine doses reduced this likelihood. Older age was a significant risk factor for systemic symptoms, while HCWs born abroad were more likely to report upper respiratory tract symptoms. Additionally, nursing staff had higher odds of experiencing psychological and social symptoms.

Key Points

- Objectives: to explore the intersection between work and long COVID for HCWs, to understand the impact of long COVID on their professional identify, their orientation to work, their wellbeing as professionals, and support needs and strategies for them as well as their managers to continue to work.
- Methods: This qualitative study was conducted through semi-structured online interviews with three groups: HCWs with long COVID, their support network members, and healthcare managers between March 2023 and May 2024.
- Data analysis: Data were analysed using reflexive thematic analysis.
- Results: a total of 42 participants were interviewed from three groups, comprising 24 HCWs, five support network members, and 13 healthcare managers. Four key themes were identified describing experiences of long COVID for HCWs: (1) Living and coping with long COVID as a HCW, (2) Workplace impact and adjustments, (3) The uncertain nature of long COVID and challenges of the definition, and (4) Feelings of guilt, stigma and blame.
- Conclusion: long COVID has created significant challenges not only for HCWs but also for their managers, who struggled with staffing shortages and lack of clear guidance, and support network members who experienced emotional strain while providing care. The combination of these challenges threatens NHS workforce stability and service delivery. Developing and embedding flexible, standardised workplace interventions-such as phased return-to-work policies and tailored occupational health support-could mitigate these impacts and inform scalable solutions across diverse healthcare systems. Enhanced training for healthcare managers and further research into culturally diverse coping mechanisms could improve support for affected HCWs, reduce stigma, and contribute to a more stable and resilient healthcare workforce. While based in the UK, these findings offer important insights for health systems globally that are grappling with the long-term workforce implications of long COVID.
- Full published article: Al-Oraibi A, et al., (2025). The impact of long COVID on UK healthcare workers and their workplace: a qualitative study of healthcare workers with long COVID, their families, colleagues and managers. BMC Health Services Research. DOI: 10.1186/s12913-025-12677-x

6. UNDERSTANDING THE IMPACT OF LONG COVID ON HEALTHCARE WORKERS, THEIR SUPPORT NETWORKS, MANAGERS, AND THE HEALTHCARE WORKFORCE IN THE UK: A QUALITATIVE STUDY

6.1 Introduction

Qualitative research has shown that long COVID presents a significant challenge for HCWs by impacting their physical health, psychological wellbeing, and professional responsibilities. Interviews with HCWs have highlighted dissatisfaction with the support received from employers despite some positive examples of workplace adjustments such as flexible working hours and phased returns.169 These narratives highlighted a moral dilemma: while they wished to be treated as 'patients,' they also felt professionally dissatisfied with the care they received.170

Existing research has focused predominantly on the physical and psychological impact of long COVID on HCWs, but there has been limited exploration of the experiences of HCWs from diverse ethnic backgrounds, their support networks, and the role of healthcare managers in supporting them. Additionally, there are limited data on how long COVID has affected HCWs' personal and work lives, as well as the strategies employed by healthcare organisations to mitigate these effects.

6.2 Methods

6.2.1Participants: sampling strategy and recruitment

We sampled participants in three stages: (1) HCWs with previous COVID-19 infection and long COVID, (2) Support network members, and (3) Healthcare managers, as shown in Figure 6.1 and detailed below.

Healthcare workers

Initially, we purposefully sampled HCWs with previous COVID-19 infection and long COVID, taking into account their ethnic background, sex, job role, and age to gather various experiences based on these characteristics. Upon completing Chapter 4, one of our findings showed that HCWs in nursing/midwifery roles and AHPs had higher odds of reporting long COVID compared to those in medical roles. Consequently, we purposefully sampled HCWs from these two professions until data saturation was reached. We recruited participants by email between March and August 2023. These were recruited from the 164 HCWs interviewed for UK-REACH qualitative work package and UK-REACH cohort study.

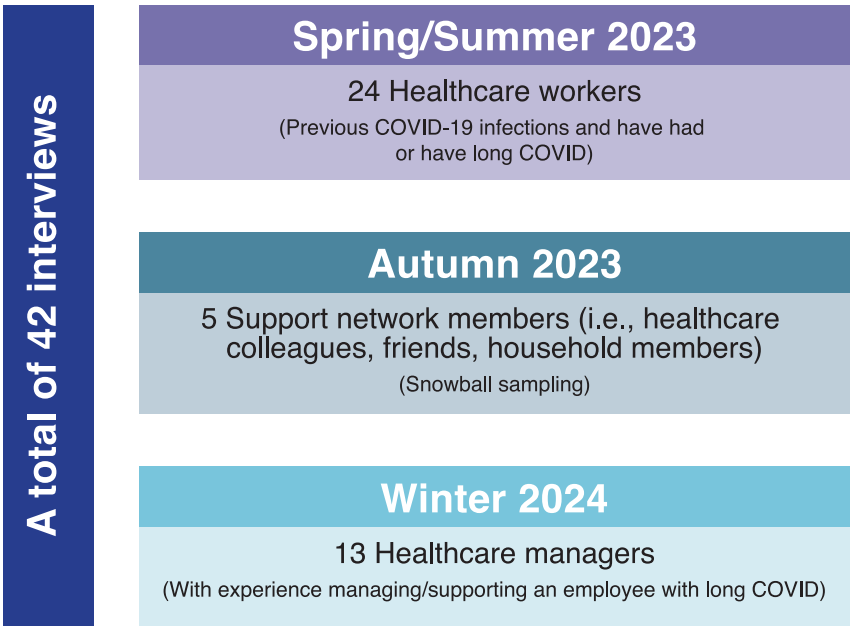
Support network members

In the second phase of the study, we recruited five participants from the support networks of interviewed HCWs using snowball sampling between September and December 2023. These case studies aimed to explore in-depth the experiences of those in support networks of HCWs with long COVID and the impacts on their home and work lives. We recruited participants through snowball sampling. For example, we invited participants to tell their family members, friends, and healthcare colleagues about the research during the online interviews.

Healthcare managers

We recruited healthcare managers, including members of managerial teams within the NHS and HR managers from outside the UK-REACH cohort, to broaden the scope of the study. We conducted these interviews between December 2023 and May 2024.

Figure 6.1. Overview of sampling phases and participants



6.2.2. Procedure

All interviews were conducted by Al-Oraibi, A in 2023 and 2024 virtually using Microsoft Teams at a time convenient for the participants.

All interviews were recorded using Microsoft Teams recording feature, with participants' permission. Interviews ranged from 32 minutes to 1 hour and 7 minutes, with an average duration of approximately 49 minutes.

6.2.3 Data analysis

Interview recordings were transcribed verbatim and anonymised by a professional transcriber. We analysed all data using reflexive thematic analysis, based on the framework initially introduced by Braun and Clarke in 2006 and 2021.[171,172]

We analysed the data by open coding all transcripts across the three participant groups using NVivo (version 1.6.1).[173]

6.3 Results

6.3.1 Participant characteristics

In total, we interviewed 42 participants from three groups, comprising 24 (57%) HCWs who had or have had long COVID, 13 (31%) healthcare managers who lead staff members with long COVID, and 5 (12%) support network members. The highest percentage of participants within each group fell in the following age ranges: HCWs (55-64 years; 33%), healthcare managers (45-54 years; 58%), and support network members (45-54 years; 60%). Across the three groups, among those who provided their gender, the majority were female, comprising 66% (N = 27), and half of the total number of participants (50%, N = 21) were from ethnic minority backgrounds. Demographic characteristics of participants are presented in **Tables 6.1, 6.2** and **6.3.**

Table 6.1. A summary of healthcare workers' demographic characteristics

Total number of HCWs = 24		
Category	**Description**	**Participants n (%)**
Gender	Female	16 (66.7%)
	Male	8 (33.3%)
Age range (in years)	35-44	4 (16.7%)
	45-54	7 (29.2%)
	55-64	8 (33.3%)
	65-74	1 (4.2%)
Ethnicity	British White	9 (37.5%)
	Other White Background	2 (8.3%)
	British Asian	2 (8.3%)
	Indian	4 (16.7%)
	Mixed	1 (4.2%)
	Other	2 (8.3%)
	Prefer not to say	1 (4.2%)
Job role	Medical	3 (12.5%)
	Allied Health Professionals	8 (33.3%)
	Nursing	6 (25.0%)
	Healthcare Science	5 (20.8%)
	Administration and Management	4 (16.7%)
	Support Services	1 (4.2%)
Country of Birth	UK	16 (66.7%)
(Years lived in the UK)	Outside UK (5-10 years)	1 (4.2%)
	Outside UK (>10 years)	6 (25.0%)
Vaccination status	Have had four doses	10 (41.7%)
	Have had three doses	13 (54.2%)
	Have had two doses	1 (4.2%)
	Have had one dose	0 (0.0%)
	Have had 0 doses	0 (0.0%)

Table 6.2. A summary of support network members' demographic characteristics

Total number of SN members = 5		
Category	**Description**	**Participants n (%)**
Gender	Female	4 (80.0%)
	Male	1 (20.0%)
Age range (in years)	35-44	1 (20.0%)
	45-54	3 (60.0%)
	55-64	1 (20.0%)
Relationship with HCW	Live in the same household (partner)	2 (40.0%)
	A friend/Neighbour	1 (20.0%)
	A work colleague	2 (40.0%)

Table 6.3. A summary of healthcare managers' demographic characteristics

Total number of healthcare managers = 13		
Category	**Description**	**Participants n (%)**
Gender	Female	7 (53.8%)
	Male	6 (46.2%)
Age range (in years)	25-34	1 (7.7%)
	35-44	2 (15.4%)
	45-54	7 (53.8%)
	55-64	2 (15.4%)
Ethnicity	British White	5 (38.5%)
	Black African	1 (7.7%)
	Indian	2 (15.4%)
	Other Asian	3 (23.1%)
	Other	1 (7.7%)
Job role	Clinical Management	4 (30.8%)
	Administrative Leadership	4 (30.8%)
	Specialist Medical Leadership	4 (30.8%)
	Scientific Leadership	1 (7.7%)
Country of Birth	UK	5 (38.5%)
(Years lived in the UK)	Outside UK (>10 years)	8 (61.5%)

Overall, we identified four key themes from the combined data: (1) Living and coping with long COVID; (2) Workplace impact and adjustments; (3) Understanding long COVID; and (4) Feelings of guilt, stigma and blame.

6.3.2 Theme 1: Living and coping with long COVID

Subtheme 1.1: Symptom experience and impact on ability to work

HCWs reported a variety of persistent symptoms that significantly impacted their ability to work. Fatigue, brain fog, and muscle pain were commonly highlighted, often compounded by other physical symptoms such as heart problems, shortness of breath, and tinnitus. These symptoms interfered with their ability to provide patient care and perform routine healthcare tasks, leading to feelings of frustration and diminished self-worth.

"You start to question your sanity, it's not because other people are doing that, and also you look perfectly normal, you look perfectly normal and people say things like 'oh you're looking really well… I'm not – I am not 100% – I am about 40%." ***(HCW16, Female, dietician, Other ethnic group)***

Brain fog, in particular, was a significant barrier, as it affected HCWs' ability to retain information, focus during critical tasks, and make decisions under pressure. The invisibility of these symptoms compounded their struggles, with participants feeling misunderstood by colleagues and managers who were unaware of their daily challenges.

Subtheme 1.2: Challenges in managing home life and the role of support network

Long COVID disrupted HCWs' ability to manage their home lives, as persistent symptoms left them unable to perform daily household tasks or care for their families. Many felt they were burdening their loved ones, who had to take on additional responsibilities. This imbalance in household roles caused emotional strain for both HCWs and their families.

> "If I had a shower, I had to lie down on the bed in my bath towel to recover before I could then get myself dressed… I wasn't cooking, I wasn't cleaning, I wasn't doing any laundry."
>
> **(HCW16, Female, Dietician, Other ethnic group)**

Support network members, including spouses and neighbours, expressed helplessness as they witnessed the struggles of HCWs. They described the emotional toll of seeing their loved ones unable to fulfil their usual roles or recover from their symptoms.

"Well I was a bit worried because I didn't know whether he was going to ever go back to being his normal self because he was so debilitated at first by it, you know, and I think it affected me because it was worrying him a bit." ***(SN01, a HCW's wife)***

This sense of helplessness extended to practical support, with participants feeling their actions were insufficient to alleviate HCWs' suffering.

"You know, to hear her coughing all night was horrible… I was texting her and stuff and I went and got her shopping and got her bits but you can't stop someone from coughing, can you?" ***(SN04, a HCW's neighbour)***

Subtheme 1.3: Coping strategies, professional identity, and resilience

Most HCWs developed coping strategies to manage their symptoms and maintain their professional responsibilities. These included exercise, mindfulness, and hobbies, which provided both physical and mental relief. Despite these efforts, their professional identity and sense of duty often became central to their resilience, pushing them to "carry on" even when their health demanded otherwise.

"I do walk to the hospital and I try to maintain at least half an hour walk because I'm about 15 minutes' walk ……So finding some way or other way I just find myself some sort of getting motivation." ***(HCW15, Female, Nurse, Asian)***

Cultural norms also influenced coping mechanisms. One participant avoided using sick leave, citing their cultural background and professional ethics as reasons to continue working despite significant symptoms.

> "I haven't got any choice. You just have to get on with it. You've just got to really focus and really concentrate and just slow down a bit. Nothing else you can do."
>
> **(HCW02, Female, Pharmacist, White British)**

"So the way I look at it is I'm [ethnic minority background] who's been here [>10 years]. So when I look at it, what would I do if I was back in [home country]? …I go and I make sure that I'm, I try and protect myself and then I carry on with it. I'm not going to sit and cry over it… I have not called in sick in the last fifteen years. I'm not going to call in sick now just because there is a loophole in the system." ***(HCW17, Male, Manager, Asian)***

These coping strategies often came at a cost, as participants prioritised their work and family over their own recovery. Support from colleagues, family members, and healthcare professionals was critical in helping HCWs navigate their challenges.

Subtheme 1.4: Healthcare service experiences

Some HCWs felt that accessing healthcare services was challenging because of the he demands of their roles as HCWs. Long shifts, staffing shortages, and organisational pressures left little time for appointments, even when symptoms worsened.

"They started a long COVID clinic, but I couldn't get the time off. I am on A&E acute medicine – I have to facilitate the bed pressure, so I couldn't really get the time off." ***(HCW23, Female, Physiotherapist, Asian)***

Participants also described feeling dismissed or misunderstood by their healthcare providers. Some were frustrated by the limited resources available and the perceived lack of understanding from both GPs and specialists.

"I went back to the GP, and at the Long COVID clinic, they told me to look at a website. I was cross. You've just exhausted me for an hour, and then you've told me to sort myself out." ***(HCW16, Female, Dietician, Other ethnic group)***

For others, cultural and familial responsibilities further compounded these barriers, as participants prioritised their duties over seeking care.

"I can't be away from my dad, I need to look after him… In my culture, we don't put ourselves first." ***(HCW19, Female, Manager, British Asian)***

Despite these challenges, many participants had positive experiences, particularly when accessing services that took a multi-disciplinary approach. This holistic care provided some peace of mind during an otherwise stressful time, as HCWs appreciated the care and attention they received.

"I thought they were very thorough actually; it was a multi-team approach." ***(HCW20, Male, GP, White Irish)***

Subtheme 1.5: Hopelessness, fears about the future of NHS, and job insecurity

Many HCWs spoke about their ongoing fears, feelings of hopelessness, and concerns related to their health, job security, and the future of the NHS. They were worried about developing long COVID or worsening existing symptoms. For some, the persistent nature of their symptoms led to a sense of despair about the future.

"Oh it's horrible! Like never-ending isn't it. And even now it's been like a year, more than a year, I really don't know, I mean, how long it's going to last and all of that, is it just going to be like that for the rest of my life now? Is it something that I have to accept after a year?" ***(HCW21, Female, Nurse, Other White)***

Long COVID symptoms, combined with pressures to return to work, created significant stress for HCWs. Many felt compelled to return prematurely, fearing job loss or being perceived as unreliable by colleagues and managers. This fear was compounded by the unpredictable nature of their condition, leaving HCWs uncertain about their future professional capacity. For some, the persistent nature of their symptoms led to a sense of despair about the future.

"I'm now back at work and struggling hugely with it because I still have long COVID and I see them two mornings, one face to face – no one at home – I'm sorry I'm going to cry!" ***(HCW13, Male, Manager, White British)***

Furthermore, many expressed deep concerns about the future of the NHS. As frontline workers, they were aware of the strain placed on the system during the pandemic, and several feared that the NHS would be unable to recover from the lasting damage. One participant reflected on the loss of colleagues to COVID-19 and the subsequent staffing shortages, worrying that without significant investment, the NHS might not be able to address the backlog of patients and the increased demand for services. This fear of collapse added to their mental strain, as they not only worried about their health but also about the ability of the healthcare system to support them and others in the future. This led many HCWs to feel a profound sense of hopelessness about their situation. For some, the emotional impacts of these combined worries became overwhelming.

"It would be nice to have somebody to wave a magic wand and go "We've come up with something to cure long COVID". That would be amazing, but it's not going to happen, certainly not in my working lifetime." ***(HCW02, Female, Pharmacist, White British)***

6.3.3 Theme 2: Workplace impact, and adjustments

Subtheme 2.1: Changes in work patterns and flexibility

Work patterns for HCWs in general have changed substantially since 2020 due to pressures of the pandemic which include increased numbers of patients, longer patients' waiting times, and busier shifts. This is in addition to the effects of long COVID in HCWs. Many HCWs spoke about the challenges they faced due to the pressures at their workplace post-COVID-19, describing it as a "backlog", when they had to reduce their working hours or transition to roles that were less physically demanding to accommodate their ongoing or persistent symptoms. One participant recounted how they gradually increased their working hours over several months, starting with just one hour a day until they were able to return to full-time work.

The introduction of flexible working arrangements was a positive change for some HCWs, allowing them to manage their symptoms while continuing to contribute professionally. Remote work was particularly beneficial for those struggling with fatigue, as it eliminated the need for commuting and allowed for more flexibility in how they structured their day. However, for others, the shift to remote work came with challenges, particularly around feelings of isolation and missing the social aspect of working in a team environment.

"Working from home and having flexible working patterns, maybe people working reduced hours, compressed hours, that kind of thing is much more commonplace now particularly within our department".
(HCW06, Female, Pharmacist, Asian)

"it's very, very, very busy. It's always been busy but somehow, post COVID, it's just, you feel patients are waiting for much longer to access care and it's almost like every minute of the day you know. It's just really very busy, very complex kind of busy if that makes sense…post COVID I felt it strongly that I wanted a little bit more of a work/life balance". ***(HCW12, Female, Consultant, Asian)***.

Subtheme 2.2: Workplace support

Workplace support experiences varied for participants. Some HCWs described positive experiences, where their managers and colleagues were understanding of their condition and worked with them to make necessary adjustments. For instance, they expressed appreciation of how their manager allowed a phased return to work, starting with just a few hours a week and gradually increasing over time.

"I was always told that if I needed longer, that was absolutely fine and not to come back until I was a hundred percent better and to look after myself…Yes, so supportive". ***(HCW24, Female, Midwife, White British)***

On the other hand, others faced significant challenges when accessing

the support they needed. Some HCWs encountered difficulties from HR departments when requesting accommodations such as phased returns or flexible work hours. In certain cases, participants expressed their frustrations with occupational health services, noting that the process was often slow and unresponsive, leaving them without adequate support for long periods. There was also a mention of how they needed to spend time and effort to explain to their management their unique experiences/symptoms with long COVID to be understood. This was also mentioned by support network members (work colleagues) in which they voiced frustrations with the lack of formal support from HR for their colleagues, which increased the strain on the team. Delays in implementing necessary accommodations, such as working from home, left both participants and their support networks feeling unsupported and let down by the system.

"If I'm being completely blunt, I don't think the Trust has really done enough about it, to look into it and maybe – they've done the whole work from home stuff which I guess could be seen as maybe helping out with people who might have long COVID but really it feels like they're putting a Band-Aid over it".
(HCW01, Male, Clinical Scientist, White British)

"She requested to work at home on the middle day… but it wasn't recognised that she'd got this condition and that she was really struggling. So I don't think they were very supportive with her when she came back."
(SN02, a HCW's work colleague).

From the perspective of managers, many expressed that while they worked hard to accommodate HCWs with long COVID, this often placed on them a considerable emotional and logistical strain. Adjusting workloads, reorganising staff, and ensuring patient care while maintaining fairness across the team required significant effort. Managers also noted that in making these adjustments, they sometimes had to compromise their own time and balance between professional and personal responsibilities.

"Because I lead the department, I have to look at what demands are and where capacity is, so I need to see how many patients need to be seen, how quickly do we need to see them, which clinics they go into. So when you start adjusting times, the first things that I personally needed to do is change the clinic slots… we have to manage that at the time it happens, because obviously you can't foresee when it happens, but what I personally would do is – because I had one staff who is now sick – is to just change things around – because she's a clinical educator so she trains a lot, so we just, with permission, ask the persons who will cover that training if they're happy to give up either if they're on day off they

could do a bank or if they're on annual leave they can take the annual leave back sometime or next week or the week after when the staff comes back. That's how I would manage it". ***(MNG02, Female, Manager, Asian)***

> "I compromised my family a bit. Because I felt I need to lead by example. If I'm asking the remaining of the staff to push harder, I need to push harder than them...It's hard. Sorry, I didn't even know I'm being upset!"
>
> **(MNG02, Female, Manager, Asian)**

Despite the pressures, many managers demonstrated a commitment to supporting their staff's health and wellbeing, emphasising the importance of recovery over work.

Nevertheless, managers often described a sense of being caught in a dilemma—wanting to support their staff but feeling as though they were neglecting others in the process. This created a complex and emotionally challenging situation for them.

"I started looking for support for Long COVID… and I was very upfront in telling them if you don't feel well don't even think of come in because you need to look after yourself first of all… it's a dilemma for me because I felt when I'm supporting one I'm neglecting the other one, that's how it felt for me as a manager, but then you're stuck between a rock and a hard place."
(MNG04, Female, Manager, Other ethnic group)

Colleagues of participants played a big role in providing day-to-day assistance and support at workplace. Some support network members described making extra efforts to check in on their colleagues and assist with their workloads. However, they also expressed the challenges this presented, particularly when the participants were managing the long-term effects of fatigue and reduced capacity. Balancing being supportive while also ensuring the department ran smoothly was expressed as a challenge to participants' colleagues.
"As a team, we've been very supportive of our colleague and checking in with her… it's finding that balance of being supportive but also running the department." ***(SN05, a HCW's work colleague)***

For some, the extended absence of their colleagues and the additional workload was stressful. Although they tried to manage the extra responsibilities, it often left them feeling overwhelmed and, in some cases, close to burnout. Despite these challenges, most support network members expressed empathy towards their colleagues' struggles, recognising that their colleagues felt guilty about the added burden they created.

"She felt so bad about having so much time off… the extra admin and the extra physical things I was doing, I did get used to it, but I was very glad when she was able to take more off me." ***(SN02, a HCW's work colleague).***

"I think as a team, we've been very supportive of our colleague and checking in with her. I think what's been very difficult is there's the fatigue problem when she was off and how she managed the fatigue when she came back and just her resilience with fatigue now is obviously challenging for her. And for her to work in the role now she's back, it's finding that balance of being supportive but also running the department." ***(SN05, a HCW's work colleague)***

Subtheme 2.3: Workplace policies and guidelines

Managers expressed feelings of indecision, fearfulness of not providing enough support for HCWs, and uncertainty regarding the policies and guidelines in place to support staff members with long COVID. Reliance on general sickness policies proved insufficient for managing a complex condition like long COVID, which required more specific guidance. Many managers described the lack of clear, long COVID-specific policies as leaving them unprepared and anxious about adequately supporting their teams.

"I've been fearful, I'm fearful that I may not be addressing their needs…will I be saying things that is quite something that may offend them? it's like walking on eggshells because there's no – to begin with there's no policy to help you to guide you with your conversations… Long COVID is such a new ailment that even the specialist doesn't fully understand as yet."
(MNG04, Female, Manager, Other ethnic group)

Managers frequently felt that long COVID was treated like other health conditions, without consideration of its unique nature, leading to ambiguity about how best to support staff.

"I feel that with Long COVID it's either we need a very clear direction … so that the resentment doesn't boil – I think it's the boiling point for the longest time because of the lack of clarity, of the lack of support"
(MNG03, Female, Manager, Other Asian)

Additionally, the absence of proper guidance left managers relying on personal assumptions, which negatively affected how they perceived long COVID cases.
"We weren't given any guidance …So when I had these discussions, I thought oh my god, I didn't know it's that bad, because I had COVID myself, so you base it on how you felt and having had COVID myself, you will not automatically switch on that Long COVID thinking because you feel that they're just making it up".
(MNG03, Female, Manager, Other Asian)

Managers also spoke about the difficulty of keeping up with constantly changing policies, which made them feel extra pressure. The frequent updates made it challenging to provide consistent and informed support to their staff.

"We had a protocol in place but it was a document that they kept changing every two weeks, so it was hard to keep track of OK what shall we do now, by the time you learn that protocol it was changed again."
(MNG10, Male, Manager, Black African)

Many managers expressed a desire for comprehensive training to better handle these situations. While leadership programmes included general HR policies, they felt this lacked depth on managing long COVID.

"You don't receive training about the policy but you receive training as a clinical lead. So I've just finished, in January I finished leadership training with the Trust… So in that session it tells you about what to do when you have somebody who's ill or somebody who's pregnant or somebody who has different needs."
(MNG13, Female, Manager, Asian)

Subtheme 2.4: Healthcare managers' struggles and coping mechanism

Healthcare managers faced significant challenges due to prolonged staff absences from long COVID, leading to increased workloads, stress, and burnout.

"Five members of staff had prolonged sickness... it's staggered kind of sickness, but they were off sick continuously for a good year, some of them two years, so the staffing has been affected, obviously the morale has been affected".
(MNG03, Female, Manager, Other Asian)

These long absences disrupted team dynamics and reduced morale, further compounding the difficulty of maintaining normal operations. Additionally, the struggle to cover shifts, especially with repeated absences, meant that the workload became overwhelming for those remaining, leading to a decline in service delivery.

"If then you start to lose like two Band 6s on one shift, you're struggling to cover your areas... so it definitely has an impact on the way the department runs, the patient care and the standards of care"
(MNG07, Female, Manager, White British)

Managers had to find creative solutions, often without additional funding, which added to their stress. Phased returns to work, while beneficial for recovery, created financial challenges.

"We are constantly trying to find more creative ways of dealing with the workload. " ***(MNG12, Male, Manager, Arab)***

"We do a phased return... but that impacts on the budget too because they'll

be paid as fulltime and then we cover their bank shift. We're double paying" ***(MNG02, Female, Manager, Other Asian)***

Some managers reconsidered their roles due to the relentless pressure of managing long COVID-related issues.

> "It's made me consider taking a different job... because I think sometimes, especially things like Long COVID, it just cause a lot of headaches that we didn't have solutions to"
>
> **(MNG10, Male, Manager, Black African)**

Despite the challenges, some managers noted positive outcomes from the experience and fostered a sense of accomplishment for some. They felt that managing the complexities of long COVID helped them grow stronger in their roles, improving their problem-solving skills and resilience

"It makes you stronger because you take the department through something which is really difficult... it works nicely for your people skills, it works nicely for increasing your resilience" ***(MNG13, Female, Manager, Asian)***

"I've learned to be really flexible now with policies, I've learned how to tailor my advice more to individual staff, I'm now more aware of the support networks that are available in the hospital." ***(MNG10, Male, Manager, Black African)***

Theme 3: Understanding long COVID

Subtheme 3.1: Perceptions of long COVID and its impact on return to work

Participants expressed varied perceptions of long COVID, reflecting personal experiences and societal attitudes, which influenced managers and colleagues understanding of how to manage and support affected HCWs, and created barriers to support for the HCWs themselves. While some acknowledged long COVID as a significant condition, others demonstrated scepticism, particularly in cases where symptoms were difficult to measure or validate. These perceptions had direct implications for workplace adjustments and support.

"I think it might be the same thing with long COVID... there probably will be people out there who are using it as a way of avoiding work or just avoiding things within a family". ***(HCW13, Male, Manager, White British)***

For many HCWs, the invisibility of long COVID symptoms made it harder for colleagues and managers to understand their struggles, creating a barrier to effective support.

> "It's like many conditions that nobody can see... long COVID, people don't get it".
>
> **(HCW02, Female, Pharmacist, White British)**

When discussing their knowledge of long COVID, participants demonstrated varying levels of awareness regarding the condition's definitions and duration of symptoms. Most understood long COVID to involve prolonged symptoms after acute infection, though there was uncertainty about for how long it would last. Many participants received their information from a range of sources, including journal articles, social media, and through conversations with colleagues at work, with some relying more on the press and less on academic or clinical guidance. "I know the symptoms are really diverse and they seem to be different with almost everybody, but the one thing that everybody reports is they feel that their life is not what it was before; they're either really tired, they find things really difficult, they're having headaches." (HCW08, Female, Dietitian, White British)

"I know people who've had symptoms for two years, three years... but I don't know the average." ***(HCW12, Female, Consultant, Asian)***

In terms of perceived risk factors, many HCWs highlighted risk factors for developing long COVID – pre-existing conditions such as diabetes and autoimmune diseases were frequently mentioned. Age, ethnicity, and the nature of one's work environment were also seen as critical factors.

"Well obviously my comorbidities – I'm obviously not the healthiest person now and my age and, like I said, my diabetes and whatnot – but obviously I'm trying to control that. I try and exercise – I'm not very good but I do try, you know, just to keep moving, because obviously my age as well".
(HCW11, Female, Admin, Asian)

Subtheme 3.2: Challenges in the definition

HCWs and managers alike experienced significant challenges due to the lack of a well-defined, formal understanding of long COVID. Many HCWs expressed frustration over the difficulty in proving the condition since it is largely self-reported without any documented evidence of initial COVID-19 infection. Managers also spoke about facing challenges in handling long COVID due to its unpredictable nature. The condition's variability in terms of symptoms and recovery times made it difficult to plan and adjust workloads. They explained that this unpredictability not only affected service delivery but also placed a strain on the remaining workforce, who often had to work longer hours to cover for absent colleagues. This unpredictability extended to the return-to-work process, creating feelings of uncertainty for them as leaders on what to expect from HCWs affected when they return to work. Furthermore, the lack of clear guidelines or understanding of long COVID exacerbated this problem as it felt to them as a "guesswork".

"I do know that there is a huge issue now about the fact that it's difficult to prove as it were that you've got long COVID because by definition it's self-reported." ***(HCW08, Female, Dietician, White British)***

The absence of an official diagnosis for long COVID posed significant hurdles. Some managers expressed frustration over the lack of a formal classification for the condition, and diagnostic criteria. Without a standardised definition of long COVID, both managers and occupational health teams struggled to categorise and respond to long COVID cases, further complicating staffing and support efforts, highlighting the difficulty in managing the condition in a consistent and informed manner.

"There's no clear guidance on long COVID because obviously there's not a formal diagnosis" ***(MNG07, Female, Manager , White British)***

Moreover, the lack of formal recognition of long COVID by health authorities led to informal pressures for staff to return to work prematurely. This was seen as a major issue. Managers felt that there was a cycle of returning too early only to relapse. This was a real a challenge for managers trying to balance compassion for affected staff with the demands of maintaining service delivery.
"People came back a bit too early, started working... and they went off sick again." ***(MNG10, Male, Manager, Black African)***

6.3.5 Theme 4: Feelings of guilt, stigma and blame

Subtheme 4.1: Feelings of guilt

HCWs dealing with long COVID reported feelings of guilt, which was recognised by managers. Managers noticed that staff members who were experiencing long COVID often felt guilty about their prolonged absence or reduced ability to work, even when such feelings were not explicitly imposed by their workplace. Despite reassurance from managers, employees still carried a personal burden, feeling the need to explain and justify their inability to return to work. This guilt was compounded by the invisible nature of long COVID symptoms, such as fatigue and brain fog, which made some employees feel misunderstood. These feelings of guilt were not necessarily a result of direct pressure from their workplace but were self-imposed by employees who were used to being high-performing, particularly in healthcare roles.

"She expressed feeling guilty because she herself didn't know what's going on, so because she doesn't know what's going on she doesn't know how long she can be off sick for. So from my point of view, it was more reassuring her that it's fine to take that time off, we're here to help and what we need is for her to at least keep us updated on how she's getting on".
(MNG10, Male, Manager, Black African)

HCWs themselves also expressed feelings of guilt. Many HCW expressed the internal conflict of wanting to contribute more at work but being physically unable to do so. This pressure to continue working often came from within, as these

employees did not want to let their colleagues down, despite not being fully capable of performing their duties. Other HCWs described the frustration and guilt of having to take sick leave, explaining how difficult it is in healthcare to step away from work. This internal conflict of prioritising their health while feeling responsible for patient care and the strain it puts on their colleagues was a recurring theme. These feelings of guilt were often exacerbated by the pressure to justify the time off and their inability to return to work. The pressure was not necessarily from management, but rather a personal sense of responsibility, particularly in a context where understaffing and the impact on patient care were constant concerns.

"I feel I push myself because I want to contribute... I don't want to feel like a complete drain on them." ***(HCW16, Female, Dietician, Other ethnic group)***

"It's really, really hard in healthcare to not go in... the guilt, and knowing the expense, and trying to get somebody to cover."
(HCW02, Female, Pharmacist, White British)

> "You're seen as weak, you're seen as somebody who doesn't really sort of care, somebody who is letting the team down, you know, it's short staffed and you're letting your colleagues down. You do feel quite a lot of pressure to continue working in the areas that are short staffed. And certainly this idea of letting your colleagues down is hard."
>
> **(HCW05, Female, Nurse, British Asian)**

Support network members also expressed feelings of guilt as they felt that the support they give was not enough and were feeling bad for not doing more.
"It made me, I mean it made me feel bad for her because I couldn't do any more. Yeah, I just text or call. That's all I could do. I did everything I possibly could."
(SN04, a HCWs' neighbour)

Subtheme 4.2: Experiences of stigma at the workplace

HCWs and managers discussed the stigma surrounding long COVID in the workplace. For HCWs, the experience of stigma often came from a sense of being judged by work colleagues. Although many HCWs reported supportive environments with colleagues who were understanding, others faced scepticism or negative attitude leading to a perception by managers that they were being seen as "workshy or opportunistic". This scepticism created an environment where HCWs felt stigmatised for taking time off to recover from long COVID, even if they were genuinely unwell. They felt the pressure to justify their illness and convince their colleagues of its existence, which created further pressure on them as they felt they were judged harshly at the workplace. In some cases, the stigma was subtle, manifesting as gossip or cynical remarks about whether the illness was legitimate. Additionally, some HCWs felt the need to justify their

absence due to long COVID to avoid being seen as faking or exaggerating their symptoms.

> "There is a huge stigma attached to people that go off sick long term for COVID, unless there is really overwhelming evidence that there's something badly wrong with them"
>
> **(HCW05, Female, Nurse, British Asian).**

"There was some scepticism... people thought maybe they were playing it up a bit"
(HCW09, Female, GP, White British).

For managers, the stigma towards long COVID employees was coupled with managing the frustration of other colleagues who had to take on the increased workload. Managers observed that the resentment toward staff members with long COVID was not necessarily personal, but rather a response to the strain placed on the team. This type of resentment, while not always openly hostile, created some tension, with employees feeling unwelcome or blamed for being unable to contribute fully, according to managers. In some cases, this stigma led to long COVID employees feeling defensive upon their return to work, as they sensed their colleagues' frustration with having had to cover their duties. The absence of a clear understanding of long COVID only worsened the situation, as employees and managers alike struggled with the unpredictable nature of the illness and its impact on the workplace.

"There was definitely guilt from those who went off sick, and when they came back... the others who had dealt with the work... were not welcoming."
(MNG03, Female, Manager, Other Asian)

6.4 Summary

We conducted a total of 42 interviews, comprising 24 HCWs, 13 healthcare managers, and 5 support network members. From the combined data we identified four key themes: (1) Living and coping with long COVID; (2) Workplace impact and adjustments; (3) Understanding long COVID; and (4) Feelings of guilt, stigma, and blame. The findings emphasise the complex challenges HCWs face in managing long COVID and highlight the overall burden on healthcare managers and its impacts in the workplace and at home. In conclusion, the experiences of HCWs managing long COVID are deeply complex, encompassing persistent physical symptoms, altered professional capacities, and significant emotional burdens.

The findings highlight a critical need for more tailored and culturally sensitive support systems within healthcare settings. The mixed responses regarding workplace support emphasise the necessity for standardised policies that

address both physical and mental health aspects of long COVID, recognising the unique challenges faced by HCWs. Enhanced training for healthcare managers to better understand and support employees with long COVID, as well as further research into culturally diverse coping mechanisms, could improve reporting of long COVID by HCWs from diverse ethnic and cultural backgrounds, and, therefore, improve outcomes for affected HCWs and their support networks.

7. DISCUSSION AND CONCLUSIONS

Key Points

- This work showed that long COVID represents a substantial burden for HCWS, with ~40% globally and 22.5–26.5% in the UK experiencing long COVID; fatigue was the most common symptom.
- Prevalence and symptom estimates varied across existing literature and this project findings, likely reflecting heterogeneity in definitions, inclusion criteria, follow-up duration, and data sources.
- Qualitative findings highlighted cultural and migration-related influences on symptom perception, reporting, and coping, including family-centred coping among some Asian participants and a potential “healthy migrant” effect on reported burden.
- There were occupational differences, with nursing, AHPs and administrative roles showing higher odds of long COVID and symptom clusters than medical roles.
- Strengths included a mixed-methods design, inclusion of clinical and ancillary staff, and triangulation across HCWs, managers/HR and support networks.
- Key limitations included cross-sectional designs (limiting causal inference), potential recall/reporting and selection bias, and self-reported data.

Interpretation of main findings

As demonstarted in this research programme and the wider literature, long COVID presents a substantial burden for HCWs—around 40% globally and 22.5–26.5% in the UK of HCWs experience long COVID—, with fatigue being the most common symptom. However, the actual prevalence estimates, and the prevalence of each symptom, varied across existing evidence and in our own studies. This is likely due to heterogeneity in definitions, inclusion criteria (suspected vs confirmed infection), hospitalisation status, follow-up length, and data sources (self-report vs routine records), alongside evolving thresholds (≥4 vs ≥12 weeks).

Qualitative findings underscored cultural and migration-related factors on prevalence findings that we found in our quantitative analyses. These factors included, resilience, with family-centred coping more prominent among some Asian participants and the "healthy migrant" effect potentially lowering reported burden. In addition, cultural differences played a role in shaping their perception of the condition and symptoms reporting, influencing the accuracy and completeness of symptom data.
Occupational patterns were consistent: nursing, AHPs and administrative roles showed higher odds of experiencing long COVID and its symptom clusters than medical roles, reflecting patient contact, physical labour and psychosocial stressors. Overall, variability in study design and context explains differences across estimates..

Strengths and limitations

To the best of our knowledge, this is the first and largest UK study examining factors associated with long COVID in HCWs, looking at impacts not only on HCWs themselves but also on their home and work lives and on managers, with implications beyond individual HCWs. Strengths of this work lie in the use of robust methods. We registered and published our review protocol for transparency, and we followed standard guidelines for each component study (e.g., PRISMA, STROBE). We investigated not only clinical HCWs but also ancillary staff, with granular data on migration status and ethnicity. The qualitative work provided a deeper understanding of the experiences of HCWs with long COVID from diverse ethnic backgrounds and job roles. Interviewing three different groups to understand the overall experience and impact was a strength that enabled triangulation of findings. We also used multiple questionnaires to capture vaccination status, long COVID symptoms, and other variables, which supported high data completeness and reliability.

Nonetheless, this research has limitations. The cross-sectional design limits our ability to establish causality and temporality between identified risk factors and long COVID. Reliance on self-reported data introduces the potential for recall and social desirability bias. The recruitment strategy, which relied partly on snowball

sampling in the qualitative interviews, may have introduced selection bias, and the sample, although diverse, may not capture the full range of experiences across different healthcare settings or cultural backgrounds. As this was a secondary analysis of a pre-existing cohort, formal a priori power calculations for subgroup analyses were not possible. We included a large sample of HCWs with a history of COVID-19 (n=4,033), over 1,000 of whom had long COVID, providing a strong foundation for identifying meaningful trends; however, while some associations reached statistical significance, their practical or clinical relevance may be limited.

Combining data from two questionnaires administered several months apart, while necessary to improve sample size and completeness, introduces the possibility of information bias. During the inter-survey period there was substantial public and professional discourse about long COVID. Given the high health literacy and media exposure of HCWs, this evolving narrative may have influenced how participants perceived and reported symptoms, particularly in the later survey, raising the possibility of reporting bias. The extended data-collection period also introduces time-related variability (e.g., vaccination status, circulating variants, public health policies, and healthcare workloads), which may affect comparability and complicate interpretation of symptom duration and prevalence.

Finally, we included both laboratory-confirmed and self-reported COVID-19 cases. While this approach aimed to capture a broad spectrum of HCWs—particularly given limited testing access in earlier stages of the pandemic—it carries a risk of misclassification. This choice reflects real-world constraints during key phases of the pandemic and aligns with other large-scale epidemiological studies using similar criteria.

Conclusions

While the quantitative findings in this report provide crucial epidemiological insights, the qualitative findings offer an equally valuable perspective on the lived experiences of HCWs with long COVID. Participants in the qualitative study reported significant challenges, including stigma, feelings of guilt, and a lack of workplace flexibility, which further exacerbated their struggles with long COVID. Many HCWs described difficulties in accessing support and adjusting to their new limitations, underscoring the need for more structured workplace policies, as highlighted by healthcare managers. These qualitative insights highlight that beyond medical management, organisational and cultural changes are necessary to better support affected HCWs in the workplace.
While these findings provide valuable insights, more work is needed to address unanswered questions and refine interventions. Specifically, longitudinal studies are required to establish causality and better understand recovery trajectories. Developing standardised definitions, diagnostic criteria, and follow-up protocols is essential to reduce biases and enhance comparability across studies. Furthermore, collecting granular data on ethnicity, occupational

roles, and regional differences remains a priority to uncover disparities and inform targeted interventions. In addition, healthcare institutions must prioritise workplace adaptations, including phased return-to-work strategies, better access to occupational health services, and manager training on long COVID support. These findings should inform policy changes that ensure HCWs with long COVID receive equitable, consistent, and sustainable workplace support. Addressing the distinct challenges faced by HCWs at higher risk of long COVID is imperative to reduce the burden of this condition, ensuring the sustainability of healthcare systems and the wellbeing of HCWs globally.

8. RECOMMENDATIONS

8.1 General recommendations

- Co-design strategies with those who have long COVID to better understand their needs. There needs to be strategies to engage with employers to work with people to provide opportunities to return to work by understanding and adapting to the particular challenges someone with long COVID experiences.
- As part of future pandemic preparedness, there should be considerations of funding, research and resources on persistent post viral symptoms.
- Clear need to further investigate the potential effects of ethnicity on long COVID including the effect of culture and language in describing ongoing symptoms.

8.2 Recommendations for practice

- Create comprehensive support frameworks that combine flexible working (home-working, reduced hours), modified duties and phased return-to-work plans.
- Standardise national policies so that every NHS trust offers the same menu of symptom-tailored adjustments (e.g., extra breaks for fatigue, task-management tools for brain fog).
- Prioritise accessible, multidisciplinary rehabilitation integrating physical, psychological and occupational therapy that is culturally competent.
- Mandate early, ongoing occupational-health consultations (physical, cognitive, psychological) to guide personalised support and review progress regularly.
- Train managers systematically and schedule regular health-and-wellbeing conversations to recognise non-linear recovery and apply compassionate adjustments.
- Run educational and anti-stigma campaigns, supported by anonymous reporting channels and success-story examples, to foster an open, supportive culture.
- Establish peer-support networks within NHS Trusts for HCWs with long COVID to share experiences and coping strategies.
- Provide robust mental-health resources and legal safeguards to protect HCWs from discrimination or job loss related to long COVID.
- Strengthen data collection and monitoring of incidence, symptom trajectories and workforce impact to inform continuous policy improvement.
- Deliver targeted interventions for vulnerable groups (older HCWs, females, those with comorbidities, ethnic-minority and migrant staff) to ensure equitable access to care and support.

8.3 Recommendations for research

- Ethnicity-focused data collection: prioritise detailed collection and analysis of ethnic data for HCWs affected by long COVID to inform targeted and culturally sensitive interventions.
- Longitudinal studies on long covid's impact: support longitudinal research exploring long-term impacts of long COVID on HCWs' health, mental wellbeing, career trajectories, and workforce retention.
- Pathophysiological and occupational risk factor research: investigate specific pathophysiological mechanisms and occupational exposure risks uniquely affecting HCWs, including interactions with vaccination.
- Standardisation of long COVID definitions and measures: develop standardised diagnostic criteria, outcome measures, and consistent data collection methodologies for long COVID research among HCWs to ensure comparability and reduce biases.
- Comparative and global research studies: conduct global comparative studies examining Long COVID prevalence, symptoms, and occupational impacts across regions and professions.

8.4 Recommendations for policy

8.4.1 Recommendations for supporting managers

- Manager-specific training and support networks: provide dedicated training, support toolkits, and facilitated peer-support networks specifically designed for managers overseeing HCWs affected by long COVID.
- Occupational health collaboration: strengthen collaborations between managers and occupational health services to enhance the timely implementation of support strategies, adjustments, and rehabilitation plans.
- Dedicated resources for managers: allocate resources and administrative support explicitly for managing Long COVID-related workload and associated complexities.
- Mental health and wellbeing support: ensure managers have direct access to psychological and emotional support to prevent burnout and sustain managerial effectiveness in supporting affected staff.
- Embed support into existing structures: integrate long covid check-ins into routine management meetings: instead of separate well-being conversations, managers can integrate long covid discussions into existing one-to-one check-ins or team huddles.
- Use electronic staff records for automatic tracking and alerts: automate reminders for follow-ups on staff with Long COVID using the NHS ESR system.
- Occupational health self-assessment forms: Instead of requiring in-person occupational health visits, provide a self-assessment tool that staff can complete online, triggering a follow-up only when needed.

- Offer on-the-job, time-efficient adjustments: allow staff to take short, scheduled breaks rather than needing entire days off. Adjust shift patterns without reducing clinical hours (e.g., split shifts, job-sharing).
- Task redistribution for symptom-specific needs: assign lighter, less cognitively demanding tasks to staff experiencing brain fog and fatigue without changing entire roles.
- Digital and remote access to support: offer online cognitive therapy, physiotherapy exercises, and peer support groups on demand, reducing the need for in-person attendance.
- Manager e-learning in bite-sized formats: instead of long training sessions, provide 5-10 min microlearning videos or case study toolkits on practical, immediate strategies for workplace adjustments.
- Simplified occupational health referral process: enable fast-track referral forms requiring minimal input rather than lengthy documentation.
- Managerial toolkits with "quick-reference" solutions: provide a 1-page decision-making flowchart for managers to quickly determine what adjustments can be implemented without needing formal HR approval.
- Pre-approved flexible working templates: Develop ready-made phased return plans which managers can quickly adapt rather than starting from scratch.
- Promote peer and team-based support: appoint local staff champions who act as peer advisors rather than relying solely on managerial oversight.
- Short team-based debriefs instead of one-to-one sessions: managers can facilitate 5-minute debriefs during shift changes instead of individual consultations.
- NHS-wide integration for standardisation: instead of local trusts creating separate resources, implement a single NHS online hub that auto-adapts recommendations based on symptoms and occupation.
- Align existing workplace accommodations: extend current disability and maternity policies to automatically cover Long COVID instead of requiring new approvals.

Summary: Time-Saving Solutions

Barrier	Time-Efficient Solution
Lack of time for meetings	Integrate into existing meetings and check-ins
Long occupational health processes	Self-assessment tools and fast-track referrals
Training burden on managers	Microlearning modules and quick-reference toolkits
HCWs lack time for support services	Remote, on-demand digital rehab and check-ins

8.4.2 Strengthening NHS employer toolkits to support staff with long COVID

NHS Employers already hosts three key resources—the Sickness Absence Toolkit, the linked page Supporting Recovery after Long COVID, and the Flexible Working Toolkit.

While these provide a useful starting point, findings from this project highlight the below recommendations that would align the toolkits with the day-to-day realities described by HCWs with long COVID, managers and support-network members.

- The NHS Sickness Absence Toolkit's current wording places full responsibility on managers—risking a sense of added burden—rather than presenting organisational structures that back them up. For example, "Long-term sickness absence is usually defined as a period of absence lasting more than 28 days. Long-term sickness absence can be a difficult time for both the affected staff member and you as their manager. Your role is to support your staff to maintain a connection with the workplace. You also need to make sure their work covered and this doesn't have a detrimental effect on the service, as well as ensuring that your organisation is doing all it can to facilitate a return to work." This could be re-framed so it emphasises the tools, escalation routes and multidisciplinary teams available to support managers (e.g., "You are not expected to do this alone—use the flow-chart, peer network and occupational-health contacts provided below"). This shifts the narrative from added duties to shared organisational responsibility, making the guidance more empowering and actionable.
- Define long COVID as a fluctuating and potentially disabling condition (refer to NASEM definitions as it's the most recent and can be re-assuring as it states that "anyone" can get long COVID.
- Common symptoms, risk factors, highlight from evidence on which occupations are at high risk as better guidance than sharing information about the general population
- A **flexible working menu** aligned to common long COVID symptoms:

Symptom	Suggested adjustements
Fatigue	Later start times, shorter shifts, more rest breaks
Brain fog	Quiet admin slots, fewer high-pressure tasks, more processing time
Myalgia	Option for rest days following intensive shifts

8.4.3 Manager "Quick Actions" Toolkit

- Add a one-page "Long COVID Management Flowchart" with step-by-step decisions (e.g., signs to refer to OH, options for redeployment).
- Checklist for first conversation with affected staff: symptom tracker, role demands review, support options.
- Template emails or meeting scripts to streamline communication.
- Share case examples of how to sensitively discuss flexible working with staff from diverse backgrounds and provide translated information or easy-read summaries about flexible working rights and pathways. This is to enhance cultural competence in flexible working.

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