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Clinical and behavioural characteristics of self-isolating healthcare workers during the COVID-19 pandemic: a single-centre observational study

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MeSH Keywords: COVID-19, Secondary Care, Cross-Sectional Studies, Health Personnel, Olfaction Disorders

ABSTRACT:

Objectives: To describe a cohort of self-isolating healthcare workers (HCWs) with presumed COVID-19.

Design: A cross-sectional, single-centre study.

Setting: A large, teaching hospital based in Central London with tertiary infection services.

Participants: 236 HCWs completed a survey distributed by internal staff email bulletin. 167 were female and 65 male.

Measures: Information on symptomatology, exposures and health-seeking behaviour were collected from participants by self-report.

Results: The 236 respondents reported illness compatible with COVID-19 and there was an increase in illness reporting during March 2020. Diagnostic swabs were not routinely performed.. Cough (n=179, 75.8%), fever (n=138, 58.5%), breathlessness (n=84, 35.6%) were reported. Anosmia was reported in 42.2%. Fever generally settled within 1 week (n=110, 88%). Several respondents remained at home and did not seek formal medical attention despite reporting severe breathlessness and measuring hypoxia (n=5/9, 55.6%). 2 patients required hospital admission but recovered following oxygen therapy. 84 respondents (41.2%) required greater than the obligated 7 days off work and 9 required greater than 3 weeks off.

Conclusion: There was a significant increase in staff reporting illness compatible with possible COVID-19 during March 2020. Conclusions cannot be drawn about exact numbers of confirmed cases due to lack of diagnostic swabbing. There were significant numbers of respondents reporting anosmia; as well as early non-specific illness prior to onset of cough and fever. This may represent pre-symptomatic HCWs who are likely to be infectious and thus criteria for isolation and swabbing should be broadened. The study also revealed concerning lack of healthcare seeking in respondents with significant red flag symptoms (severe breathlessness, hypoxia). This should be addressed urgently to reduce risk of severe disease being detected late. Finally, this study should inform trusts that HCWs may require longer than 7 days off work to recover from illness.

Strengths and limitations of this study:

- To the authors' knowledge, this study presents one of the first descriptive data analysis of self-reported healthcare worker (HCW) COVID-19 exposures and symptomatology in the UK.
- Study respondents represented a broad range of job roles, including both frontline clinical and non-patient facing staff.
- The inclusion of questions focusing on health-seeking behaviour allows results to be used to inform human resource management in the developing pandemic, and provides concerning but important data around late healthcare seeking in HCWs
- Data were self-reported, cross-sectional and retrospective, which may be subject to recall bias, and the lack of diagnostic swabbing in the majority of respondents limits interpretation of the data
- Full demographic data were not collected on participants and certain staff groups may have been over-represented in the sample, which may introduce sampling bias.

BACKGROUND:

In response to the COVID-19 pandemic, the UK government enacted a range of policies in an attempt to limit the spread of infection. These included guidelines on self-isolation for symptomatic individuals and a formal social distancing policy [1]. Healthcare workers (HCW) are at a disproportionate risk for COVID-19 disease through occupational exposure. Additionally, there are emerging concerns that HCWs may be at an additional risk of developing severe disease through repeated exposure to high viral load in the clinical environment [2]. This has implications for workforce planning and operational preparedness in the current crisis.

Testing for SARS-CoV-2 has not been routinely available for UK healthcare workers. Instead, HCWs have been advised to self-isolate for a minimum of 7 days from the onset of symptoms and return to work after this period if symptom free [3]. Earlier guidance (during the period of survey completion) advised seeking formal medical attention if difficult breathing developed, this was later updated to any subjective deterioration or failure to improve [4]. Avenues of medical advice open to patients in the UK include: NHS 111, a free online and telephone triage and advice system; the patient's own general practitioner (GP); and Accident and Emergency (A&E)

departments in secondary care. These resources are in addition to informal health advice provided by friends, family or colleagues. Little is currently described about healthcare seeking behaviour in HCWs.

A range of symptoms have been described in individuals with suspected and confirmed COVID-19, including fever, cough and shortness of breath [5,6]. Despite a multitude of recent clinical studies there is still limited published work describing symptoms amongst HCWs [7,8]. Given the differential occupational exposure of HCWs, there is the potential that the spectrum of symptoms experienced may differ from that of the general public.

In this study we describe the experiences and symptoms of HCWs self-isolating for presumed COVID-19 infection in a cohort of frontline HCWs in a central London teaching hospital. We also characterise behaviours surrounding self-care, isolation and return to work. This will aid in better understanding the spectrum of illness amongst HCWs, inform future HCW testing strategies and provide data to support human resource management in the developing pandemic.

METHODS:

We performed a cross sectional, single-centre study of NHS HCWs who had self-isolated with symptoms compatible with COVID-19 prior to April 2020. Participants were recruited from University College London Hospitals NHS Foundation Trust by distributing the voluntary survey via staff email bulletin to all staff departments from 1st April 2020 - 10th April 2020. Consent was obtained via electronic signature. Responses were devoid of personal identifiers and were collected and processed via Form Assembly Enterprise cloud https://www.formassembly.com/. All data was stored in compliance with the General Data Protection Regulation (EU GDPR 2016/679) and Data Protection Act (UK 2018). The survey was approved by the Hospitatl of Tropical Diseases research and audit committee who deemed that it did not require ethical approval in line with UCLH guidance [9]. Anonymous data was exported to Microsoft Excel 2010 (Microsoft Corporation) and R (R Development Core Team 2008) for analysis. Venn diagrams were generated using Venny 2.1.0 (https://bioinfogp.cnb.csic.es/tools/venny/) [10] and BioVenn (https://www.biovenn.nl/) [11].

RESULTS:

Demographics, timeline and exposure history

There were 236 respondents to the survey of which 167 (70.8%) were female and 65 (27.5%) male (Table 1). Respondents were aged between 18 and 71. The respondents were from a broad range of hospital roles with the most common groups being doctors (33.5%) and nurses (25.4%). There was a broad range of other professions represented. The majority were non smokers (79.7%), with 32 (13.6%) ex-smokers and eight current smokers (3.4%). Twenty-four respondents (10.2%) reported being in a vulnerable group according to Public Health England criteria [1].

Table 1. Demographics of respondents

Demographic	**n=236 (%)**
Sex	
Female	167 (70.8)
Age	

18-28	53 (22.5)
29-39	88 (37.3)
40-50	66 (28.0)
50-60	21 (8.9)
61-71	3 (1.3)
Workplace	
UCH*	229 (97.0)
Other	4 (1.7)
Hospital	228 (96.6)
Community	5 (2.1)
Job Role	
Doctor	79 (33.5)
Nurse	60 (25.4)
Administrator	18 (7.6)
Other	17 (7.2)
Other allied healthcare professional	17 (7.2)
Radiographer	14 (5.9)
Manager	9 (3.8)
Healthcare assistant	8 (3.4)
Physiotherapist	6 (2.5)
Dietician	4 (1.7)
Other non-clinical support	2 (0.8)
Occupational Therapist	1 (0.4)
Smoking Status	
Smoker	8 (3.4)
Non-smoker	188 (79.7)
Ex-smoker	32 (13.6)
Vulnerable Group†	
Yes	24 (10.2)

*University College Hospital
†As defined by Public Health England [https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people/]

Table 1: Demographics of respondents. Demographic data collected via survey from staff at University College Hospital London**.**

Known direct contact with SARS-CoV-2 positive patients was reported in 81 HCWs (34.3%) (Figure 1A), of which 24 (29.1%) of these were in appropriate personal protective equipment as perceived by respondents. Over half of those surveyed (128 respondents, 53.4%) were not aware of having had any direct contact with COVID-19 positive patients. Initial suspected cases were identified in mid-February and increased until late March 2020 (Figure 1B).

Clinical symptoms reported during self isolation

The most commonly reported symptoms included headache (78.8%), cough (75.8%), myalgia (63.6%) and fever (58.5%) (Table 2). Eighty-four respondents (35.6%) reported dyspnea during their illness; of these 41 patients (17.4%) reported shortness of breath only on exertion with only 12 patients (5.1%) reporting shortness of breath at rest. Nearly one third of HCWs experienced symptoms beyond 14 days (73 respondents, 30.9%).

Table 2. Symptoms reported during self-isolation, and early symptoms prior to self-isolation

Symptom During Self Isolation	**n=236 (%)**
Headache	186 (78.8)
Cough	179 (75.8)
Arthralgia/Myalgia	150 (63.6)
Fever/Chills	138 (58.5)
Pharyngitis	134 (56.8)
Coryzal Symptoms	117 (49.6)
Sleep Disturbance	99 (41.9)
Anosmia	97 (41.1)
Shortness of Breath	84 (35.6)
Diarrhoea	75 (31.8)
Anxiety	72 (30.5)
Chest Pain	65 (27.5)
Rash	13 (5.5)
Vomiting	10 (4.2)

Symptoms Prior to Self-Isolation	n=185 (%)
Fatigue	92 (49.7)
Chills/Rigors	45 (24.3)
Headache	44 (23.8)
Pharyngitis	38 (20.5)
Malaise	28 (15.1)
Sleep Disturbance	23 (12.4)
Myalgia	23 (12.4)
Rhinorrhoea	15 (8.1)
Anosmia	13 (7.0)
Poor concentration	13 (7.0)
Chest pain	12 (6.5)
Dysgeusia	12 (6.5)

Table 2: Symptoms during self isolation; symptoms prior to self isolation. Respondents were asked to report symptoms they experienced whilst self isolating and unwell with an illness they perceived to be COVID-19. The number of respondents reporting each symptom is shown. Respondents were subsequently asked to report symptoms that preceded self isolation. The symptoms occurring earlier in their illness prior to self isolation are shown in the lower section of the table.

A number of those surveyed reported a prodromal syndrome prior to the appearance of the symptom which precipitated self-isolation. These included fatigue (92 respondents, 39.0%), chills (45 respondents, 24.3%) and headache (44 respondents, 23.8%).

Dynamics and clustering of symptoms reported during illness

Of 125 HCW with fever only 15 (12%) reported fevers beyond day 7 of illness (Figure 2A). Most respondents reported at least one of the most commonly reported three symptoms with only 9 individuals (3.8%) not reporting headache, cough and/or myalgia (Figure 2B). Assessing symptom overlap demonstrated that for the three most commonly reported symptoms in the cohort (headache, cough & myalgia), approximately two-thirds of respondents reporting each symptom also reported fever (Figure 2C). Correlation analysis of all symptoms did not demonstrate any clear symptom clusters except from cough, shortness of breath and chest pain. Shortness of breath and chest pain were described by a minority of respondents (Figure 2D).

A variety of neurological syndromes have been linked to COVID-19 [11]. In particular anosmia has been reported to be a specific indicator of COVID-19 disease [12]. Ninety-one respondents described anosmia during their illness (41.1%) and 13 reported anosmia as part of a viral prodrome (7.0%). Most individuals with anosmia also reported headache, although this was in the context of headache being the most common symptom overall (78.8% of

respondents) (Figure 2D). Onset of anosmia peaked at day 3-4 of illness with 84% reporting symptomatic resolution within 14 days (Figure 2E).

Healthcare seeking behaviour in HCWs

Respondents commonly sought advice regarding their illness informally (26.7%), via NHS 111 (25.4%) and general practice (7.6%). Two patients attended Accident and Emergency and required oxygen therapy during hospital admission. No respondents required non-invasive or invasive ventilation.

A minority of respondents had access to monitoring of oxygen saturations during their illness, and of those who commented on saturation levels, 11 (4.7%) described saturations below 94% during their illness to variable degrees of desaturation. Two respondents reported saturations below 85% either at rest or exertion. Only 41.7% of those with breathlessness at rest (n=12) and 44.2% of those who were breathless on exertion (n=43), sought formal medical advice (Figure 3A). Notably 9 respondents reported a combination of breathlessness and saturations less than 94% at rest; of these respondents 5 (55.6%) did not seek any formal healthcare advice (Figure 3B).

Self isolation and return to work

The majority of respondents (57.3%) did not feel able to effectively distance themselves from household members whilst unwell (as defined as access to a separate bedroom and/or toilet) (Figure 3C). Close contacts (defined as sharing a bed with symptomatic respondent on night prior to symptom onset) frequently became unwell during the 14 days after symptom onset of respondents (Figure 3C). Time to return to work varied in this cohort, with a significant number of respondents requiring greater than 7 days off work prior to return (Figure 3D). Nine respondents required greater than 3 weeks off work (4.4%). In addition 20% of respondents felt they returned to work before they felt ready.

DISCUSSION:

To the authors knowledge this is one of the first descriptive studies on the presentation of Presumed COVID-19 in HCWs in the UK. The only other peer reviewed study looking at HCW COVID-19 infection in the UK by Hunter et al [13] reported SARS-CoV2 positivity rates during a HCWs testing programme in March 2020. They found a steep rise in confirmed COVID-19 cases corresponding with the data we present on presumed infections. Whilst an important insight into the epidemiology of COVID-19 in HCWs, this study did not provide data on clinical presentation or behavioural aspects of HCW infection, and occupational data was not available in the majority of participants. This study therefore provides novel data on healthcare seeking behaviour, self-isolation facilities, and return to work timelines of HCWs with presumed COVID-19. The study is limited by the fact that respondents did not have access to diagnostic swabs during their illness and therefore any non-COVID-19 related symptoms triggering self-isolation (e.g. due to other respiratory viral infections) amongst respondents may confound conclusions derived from these results. Whilst the data should therefore be interpreted with caution, the overall data temporally match with the COVID-19 outbreak across London. This suggests that self-reported symptoms may be a reasonable surrogate for the illness during the outbreak. We identified 2.9% of the 9000 clinical and administrative staff members at UCLH reporting symptoms consistent with COVID-19 [14]. The use of a voluntary online survey to collect this data has a number of sources of bias. In particular it is unlikely that every self-isolating HCW was captured by this approach and we suspect that our sample over-represents the number of training grade doctors in our sample given that 33.9% of the survey population were doctors. This could represent that clinical facing staff (nurses, doctors and healthcare assistants) were more likely to develop symptoms. Alternatively, they could have been more likely to respond to the survey given the email bulletin tends to reflect clinical guideline changes and up to date policy each day. The peak of cases seen at the end of March 2020 may indicate increased community transmission, with

lockdown being introduced in the UK on 23rd March 2020 and after social distancing measures. It could also represent staff-to-staff transmission prior to the guidance from Public Health England to self-isolate with symptoms. Future studies could evaluate contact tracing in relation to staff-staff interactions during a lockdown period when R0 is believed to be <1 for the community population to estimate nosocomial spread.

The symptoms described by respondents are in keeping with those described in previous cohorts of non severe COVID-19 patients. In our study there was a significant proportion of this cohort reporting anosmia - 41.5% - which has not been described to this extent in other upper respiratory tract infections [15]. We also describe respondents reporting non-specific symptoms early in their illnesses prior to onset of self isolation triggered by cough or fever. The presence of sore throat, profound fatigue and anosmia early in the presentation should therefore prompt staff testing strategies to include all these symptoms in the clinical case definition even in the absence of fever or new continuous cough. A diagnostic swab early on in the course of the syndrome will enable health care workers who are infectious to stay at home to limit onward transmission within healthcare settings.

Our findings indicate that for the majority of healthcare workers this is a self-limiting illness of less than one week. However, a significant minority remain unwell beyond 8 days and many have protracted illnesses beyond this. Notably, severe COVID-19 illness in HCW is likely to be under-represented in our sample due to selection bias. A particular point of concern raised by our study is that a significant proportion of healthcare workers did not seek formal medical advice or assessment despite significant shortness of breath and/or hypoxia. More worrying perhaps also is the HCWs who reported significant breathlessness and measured hypoxia using home oximetry and still did not seek formal medical attention. The reasons for this reluctance to seek formal care were not captured by the survey. It will be important for Trusts across the United Kingdom to ensure they have mechanisms in place to encourage staff to seek medical advice if they develop shortness of breath, and ensure adequate pathways are in place to support such seeking of care. This may be an important point of intervention to reduce HCW morbidity and mortality.

Many staff reported symptoms prior to 13th March 2020, after which Public Health England introduced guidance to healthcare workers to self-isolate for 7 days if they had symptoms of a continuous cough or fever (Figure 1). These individuals were not subject to isolation restrictions and therefore many of whom isolated for under 7 days or not at all. Our findings indicate that HCW respondents lack the ability to self isolate effectively away from family members, and that significant numbers of close contacts of HCWs became unwell in the period following respondents' symptoms. Hospital trusts should consider provision of hospital accommodation for staff unwell with COVID-19 to minimise onward transmission to their home contacts; especially when household contacts of HCWs are in vulnerable groups. The return to work data in this study suggests that hospital trusts should expect significant numbers of HCWs to require beyond 7 days of leave prior to return. Current guidelines to self isolate for 7 days may lead to an expectation of return to work at this stage, whereas our data suggests many staff will require more time off work than the minimum recommended by PHE. Indeed, 1 in 5 staff felt they returned to work too soon. Staff members will therefore need support to ensure they are back to full health prior to returning to work and feel supported in this return and this could help inform occupational health and workforce management policy going forward.

In summary this study was limited because the majority of respondents were not confirmed with positive swabs. Given the lack of access to a diagnostic test for the majority of respondents the survey may include participants with illnesses that mirror COVID-19. In addition, we may have missed recruiting participants who had very mild or very severe symptoms that may not have completed the survey. Recruitment occurred by email bulletin which may lend bias to response rates in different staff groups, particularly clinical and patient facing staff who may be more

likely to check bulletins for daily guidance changes. Future studies looking at symptom prevalence, healthcare seeking behaviour and return to work in HCWs in confirmed cases of COVID-19 will further inform the area. Similarity in data between our study and confirmed cohorts may validate the use of symptom surveys in data collection for staff illness in COVID-19. Hospital trusts should urgently address issues raised regarding delayed healthcare seeking in staff with hypoxia and severe breathlessness.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. **(b)** Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

Figure 2: Duration of reported fever in self isolating healthcare workers (A); symptom clustering reported during illness (B, C, D); and characterisation of anosmia (E) (a) respondents were asked to report the duration of their fever. The majority of respondents reported fever duration less than 7 days (n=110, 88). Fever persisted to 7 days or more in 12% (n=15) **(b)** Non-proportional Venn diagram (generated using Venny[1]) demonstrating the crossover between the three most commonly reported symptoms (headache, cough and myalgia). The purple ellipse demonstrates the all patient denominator. Only 9 respondents (3.8%) did not report any of these symptoms. **(c)** Proportional Venn diagrams (generated using BioVenn[2]) demonstrating the crossover between fever (reported by 58.5% of respondents) and the three most commonly reported symptoms – headache, cough and myalgia. Grey circles demonstrate the denominator (all respondents), light red circles show
respondents reporting fever and burgundy circles show respondent reporting other symptoms. Percentages in white show the proportion of the overall group of respondents reporting both fever and the relevant second symptom.**(d)** Proportional Venn diagrams (generated using BioVenn[2]) demonstrating the crossover between shortness of breath & chest pain, and headache & anosmia. Grey circles demonstrate the denominator (all respondents). Percentages in white show the proportion of the overall group of respondents reporting both symptoms in each Venn. **(e)** Respondents reporting anosmia (n=91, 41.1%) were asked the day of onset and duration of this symptom. The majority of respondents developed anosmia early in illness (median day 3, SD 1.96) and had resolution of anosmia within 2 weeks of its onset (n=75, 84%).

Figure 3: Healthcare seeking behaviour as triggered by breathlessness in HCWs (A); Access to self isolation facilities (B); illness in close contacts of HCWs (C); return to work timeline (D). (a) 84 respondents reported breathlessness (35.6%); increased severity of breathless did not appear to lead to increased formal healthcare seeking in respondents. Of those respondents reporting breathlessness at rest (n=12), only 41.7% (n=5/12), sought formal medical attention (NHS 111, GP, A&E) (b) 9 respondents reported a combination of breathlessness and saturations of <94% (measured using home oximeters). A majority (n=5/9,) of those respondents sought either no or informal advice only. (c) Respondents were asked if they felt able to self isolate away from other household members (seperate bedroom, bathroom). A majority did not feel able to to self isolate in this way (n= 126, 57.27%). (d) Respondents were asked whether their partner became unwell (phrased as 'sharing bed on night of symptom onset') during 14 days after symptom onset. A majority (n=125 , 61.13%) reported their partners did become unwell during this period.

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Figure 1

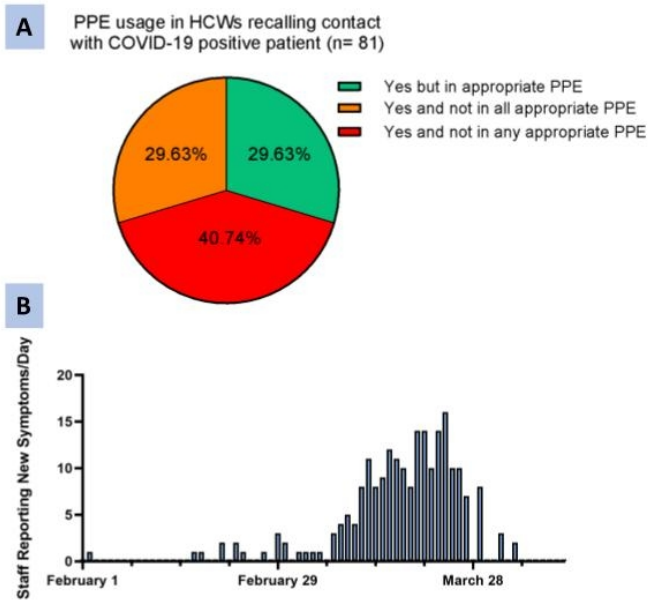

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. **(a)** 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. Figure shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. **(b)** Respondents were asked to report their first day of symptom onset. Chart shows day of onset on illness.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. (b) Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

254x366mm (72 x 72 DPI)

Figure 2

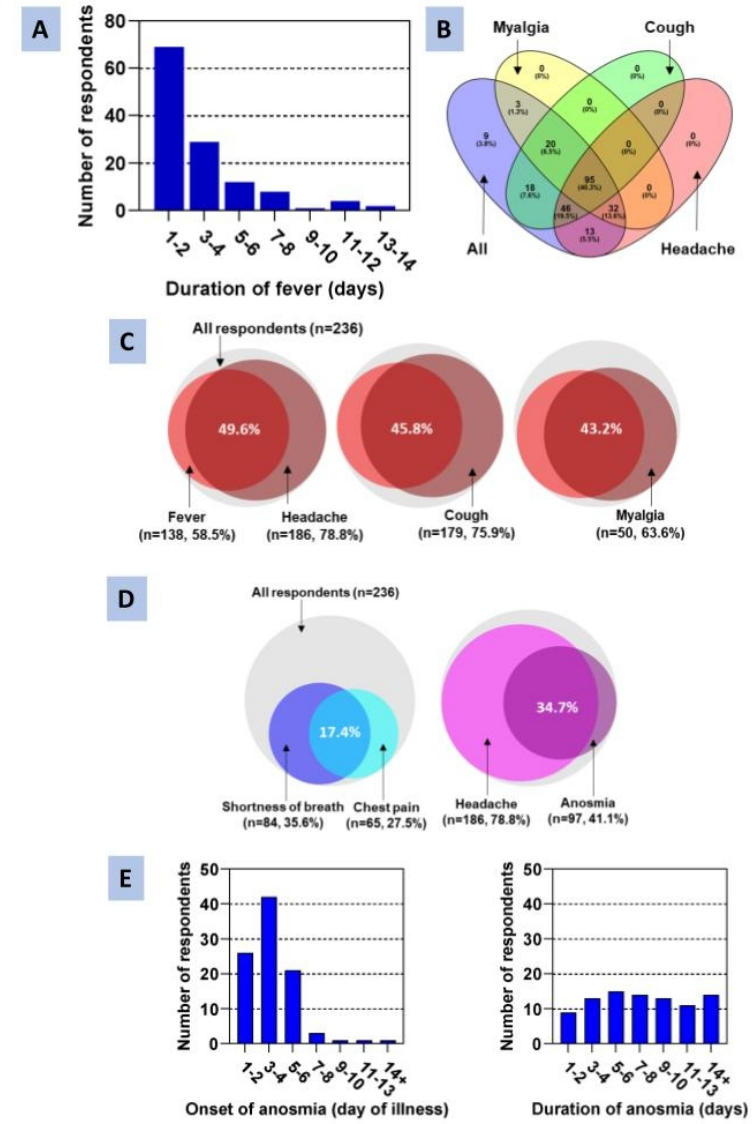

Figure 2: Duration of reported fever in self isolating healthcare workers (A); symptom clustering reported during illness (B, C, D); and characterisation of anosmia (E) (a) respondents were asked to report the duration of their fever. The majority of respondents reported fever duration less than 7 days (n=110, 88). Fever persisted to 7 days or more in 12% (n=15) (b) Non-proportional Venn diagram (generated using Venny1) demonstrating the crossover between the three most commonly reported symptoms (headache, cough and myalgia). The purple ellipse demonstrates the all patient denominator. Only 9 respondents (3.8%) did not report any of these symptoms. (c) Proportional Venn diagrams (generated using BioVenn2) demonstrating the crossover between fever (reported by 58.5% of respondents) and the three most commonly reported symptoms – headache, cough and myalgia. Grey circles demonstrate the denominator (all respondents), light red circles show
respondents reporting fever and burgundy circles show respondent reporting other symptoms. Percentages in white show the proportion of the overall group of respondents reporting both fever and the relevant second symptom.(d) Proportional Venn diagrams (generated using BioVenn2) demonstrating the crossover between shortness of breath & chest pain, and headache & anosmia. Grey circles demonstrate the

denominator (all respondents). Percentages in white show the proportion of the overall group of respondents reporting both symptoms in each Venn. (e) Respondents reporting anosmia (n=91, 41.1%) were asked the day of onset and duration of this symptom. The majority of respondents developed anosmia early in illness (median day 3, SD 1.96) and had resolution of anosmia within 2 weeks of its onset (n=75, 84%).

254x366mm (72 x 72 DPI)

Figure 3

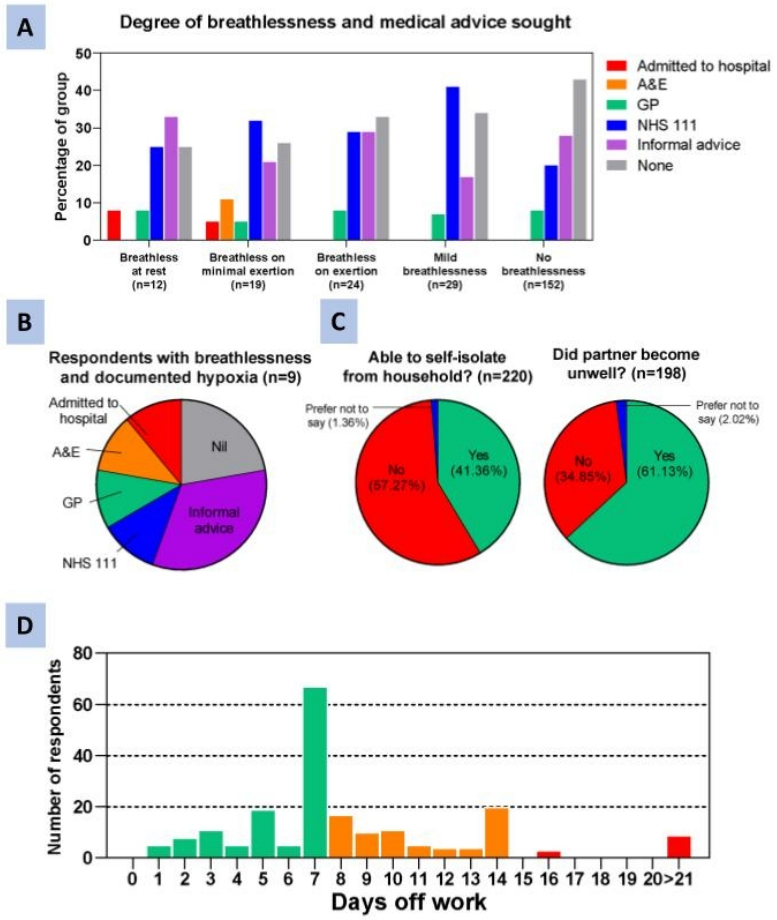

Figure 3: Healthcare seeking behaviour as triggered by breathlessness in HCWs (A); Access to self isolation facilities (B); illness in close contacts of HCWs (C); return to work timeline (D). (a) 84 respondents reported breathlessness (35.6%); increased severity of breathless did not appear to lead to increased formal healthcare seeking in respondents. Of those respondents reporting breathlessness at rest (n=12), only 41.7% (n=5/12), sought formal medical attention (NHS 111, GP, A&E) (b) 9 respondents reported a combination of breathlessness and saturations of <94% (measured using home oximeters). A majority (n=5/9,) of those respondents sought either no or informal advice only. (c) Respondents were asked if they felt able to self isolate away from other household members (seperate bedroom, bathroom). A majority did not feel able to to self isolate in this way (n= 126, 57.27%). (d) Respondents were asked whether their partner became unwell (phrased as 'sharing bed on night of symptom onset') during 14 days after symptom onset. A majority (n=125 , 61.13%) reported their partners did become unwell during this period.

254x366mm (72 x 72 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1
Objectives	3	State specific objectives, including any prespecified hypotheses	1
Methods			
Study design	4	Present key elements of study design early in the paper	2
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	2
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	2
Study size	10	Explain how the study size was arrived at	3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	2-3
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	N/A
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	2
		(b) Give reasons for non-participation at each stage	2
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	3
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	2-3
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	3-4
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	4
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	3-4
Generalisability	21	Discuss the generalisability (external validity) of the study results	4
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Clinical and behavioural characteristics of self-isolating healthcare workers during the COVID-19 pandemic: a single-centre observational study

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Primary Subject Heading:	Infectious diseases
Secondary Subject Heading:	Infectious diseases, Public health, Respiratory medicine, Qualitative research, Occupational and environmental medicine
Keywords:	EPIDEMIOLOGY, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES, INFECTIOUS DISEASES

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Clinical and behavioural characteristics of self-isolating healthcare workers during the COVID-19 pandemic: a single-centre observational study

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†Eliz Kilich, Zain Chaudhry, Lucy CK Bell and Joshua Gahir contributed equally to the manuscript and are joint second co-authors on this project.

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MeSH Keywords: COVID-19, Secondary Care, Cross-Sectional Studies, Health Personnel, Olfaction Disorders

ABSTRACT:

Objectives: To describe a cohort of self-isolating healthcare workers (HCWs) with presumed COVID-19.

Design: A cross-sectional, single-centre study.

Setting: A large, teaching hospital based in Central London with tertiary infection services.

Participants: 236 HCWs completed a survey distributed by internal staff email bulletin. 167 were female and 65 male.

Measures: Information on symptomatology, exposures and health-seeking behaviour were collected from participants by self-report.

Results: The 236 respondents reported illness compatible with COVID-19 and there was an increase in illness reporting during March 2020. Diagnostic swabs were not routinely performed. Cough (n=179, 75.8%), fever (n=138, 58.5%), breathlessness (n=84, 35.6%) were reported. Anosmia was reported in 42.2%. Fever generally settled within 1 week (n=110/138, 88%). Several respondents remained at home and did not seek formal medical attention despite reporting severe breathlessness and measuring hypoxia (n=5/9, 55.6%). 2 patients required hospital admission but recovered following oxygen therapy. 84 respondents (41.2%) required greater than the obligated 7 days off work and 9 required greater than 3 weeks off.

Conclusion: There was a significant increase in staff reporting illness compatible with possible COVID-19 during March 2020**.** Subsequent serology studies at the same hospital study site have confirmed sero-positivity for COVID-19 up to 45% by the end of April 2020 frontline HCWs. Within this cohort there were significant numbers of respondents reporting anosmia, as well as early non-specific illness prior to onset of cough and fever. The study revealed a concerning lack of healthcare seeking in respondents with significant red flag symptoms (severe breathlessness, hypoxia). Finally, this study supports the updated guidance from PHE requiring a 10 day isolation period, as many of the HCWs in this study required longer than 7 days off work to recover from illnes.

Strengths and limitations of this study:

- This study describes a large cohort of self-reported healthcare worker (HCW) COVID-19 illness during the peak of the COVID-19 pandemic in London.
- Study respondents represented a broad range of job roles, including both frontline clinical and non-patient facing staff in a hospital setting proven to have high incidence of COVID-19 infection during the study period
- The inclusion of questions focusing on health-seeking behaviour allows results to be used to inform human resource management in the developing pandemic, and provides concerning but important data around late healthcare seeking in HCWs
- Limitations include the use of a self-reported, cross-sectional and retrospective survey, which may be subject to recall bias. The lack of diagnostic swabbing in the majority of respondents limits interpretation of the data, although later serological studies have shown high COVID-19 infection rates at the study hospital
- Full demographic data were not collected on participants and certain staff groups may have been over-represented in the sample, which may introduce sampling bias.

BACKGROUND:

In response to the COVID-19 pandemic, the UK government enacted a range of policies to limit the spread of infection. These included guidelines on self-isolation for symptomatic individuals and a formal social distancing policy [1]. Healthcare workers (HCWs) are at a disproportionate risk for COVID-19 disease through occupational exposure [2]. Additionally, there are emerging concerns that HCWs may be at an additional risk of developing severe disease through repeated exposure to high viral load in the clinical environment [3]. This has implications for workforce planning and operational preparedness in the current crisis.

At the time of the study, SARS-CoV-2 testing was not routinely available for UK HCWs. Instead, HCWs fitting the Public health England (PHE) case definition for COVID-19 infection (persistent cough, fever) were advised to self-isolate for a minimum of 7 days from the onset of symptoms and return to work after this period if symptoms free [4]. Governmental websites advised seeking formal medical attention only if difficult breathing developed initially; this was later updated to any subjective deterioration or failure to improve [5]. Avenues of medical advice open to patients in the UK include NHS 111, a free online and telephone triage and advice system; the patient's own general practitioner (GP); and Accident and Emergency (A&E) departments in secondary care. These resources are in addition to informal health advice provided by friends, family, or colleagues. Little is currently described about healthcare seeking behaviour in HCWs.

At the time of the study, several symptoms had been described in individuals with suspected and confirmed COVID-19, including fever, cough and shortness of breath [6,7] with few detailed studies looking specifically at HCW illness [8,9]. This study aimed to characterise the utility of a survey based study in HCWs to characterise this symptomatology more thoroughly.

In this study we describe the experiences and symptoms of HCWs self-isolating for presumed COVID-19 infection in a cohort of frontline HCWs in a central London teaching hospital known to have very high levels of staff COVID-19 sero-positivity [2]. We also characterise behaviours surrounding self-care, isolation and return to work. This will aid in better understanding the spectrum of illness amongst HCWs, inform future HCW testing strategies and provide data to support human resource management in the developing pandemic.

METHODS:

We performed a cross sectional, single-centre study of NHS HCWs who self-isolated with symptoms compatible with COVID-19 during the early COVID-19 pandemic. The study was designed as a survey based cross sectional study of HCWs unwell early in the pandemic. The study setting was University College London Hospitals NHS Foundation Trust. Eligibility criteria were: current employment at University College London Hospitals NHS Foundation Trust, and haven undertaken self-isolation since March 1st with either a fever or persistent cough as per the PHE guidelines for HCWs. Participants were recruited via staff email bulletin to all staff departments. Patients and pubic were not recruited to the study. Participants were asked to report potential exposures to COVID-19, access to personal protective equipment (PPE), variety and duration of symptoms, occupational health data and healthcare seeking behaviours. Data sources were by self-reported survey (supplementary file) and the study did not obtain access to medical records of participants. The study size was determined by the number of respondents during the survey window, with reminder emails sent regularly. The study team attempted to reduce selection bias by circulating the email survey to as many departments as possible, and attempting to recruit from both clinical and non-clinical settings. The survey was open between 1st April and 10th April 2020. Consent was obtained via electronic signature. Responses were devoid of personal identifiers and were collected and processed via Form Assembly Enterprise cloud https://www.formassembly.com/. All data was stored in compliance with the General Data Protection Regulation (EU GDPR 2016/679) and Data Protection Act (UK 2018). The Study was approved by the Audit and Research Committee at the Hospital of Tropical Diseases, UCLH [10]. Anonymous data was exported to Microsoft Excel 2010 (Microsoft Corporation) and R (R Development Core Team 2008) for analysis. Chi Squared univariate analyses were performed using R to determine association between patient factors and duration of time off work, and healthcare seeking behaviour. The majority of data was presented in a descriptive fashion. Venn diagrams were generated using Venny 2.1.0 (https://bioinfogp.cnb.csic.es/tools/venny/) [11] and BioVenn (https://www.biovenn.nl/) [12] to describe overlap of symptom clusters.

Patient and Public involvement

This study involved NHS staff members only and did not recruit from the general public or NHS patient population. Results will be disseminated to staff via email bulletin.

RESULTS:

Demographics, timeline and exposure history

During the study period 984 staff were recorded as being off work with confirmed or possible COVID-19 at the study site, of which 236 responded to our survey. Of the 236 respondents to the survey 167 (70.8%) were female and 27.5% male (Table 1). Respondents were aged between 18 and 71. The respondents were from a broad range of hospital roles with the most common groups being doctors (33.5%) and nurses (25.4%). There was a broad range of other professions represented. The majority were non-smokers (79.7%), with 32 (13.6%) ex-smokers and eight current smokers (3.4%). Twenty-four respondents (10.2%) reported being in a vulnerable group according to Public Health England criteria [1].

Table 1. Demographics of respondents

Demographic	**n=236 (%)**
Sex	
Female	167 (70.8)
Age	
18-28	53 (22.5)
29-39	88 (37.3)
40-50	66 (28.0)
50-60	21 (8.9)
61-71	3 (1.3)
Workplace	
UCH*	229 (97.0)
Other	4 (1.7)
Hospital	228 (96.6)
Community	5 (2.1)
Job Role	

Doctor	79 (33.5)
Nurse	60 (25.4)
Administrator	18 (7.6)
Other	17 (7.2)
Other allied healthcare professional	17 (7.2)
Radiographer	14 (5.9)
Manager	9 (3.8)
Healthcare assistant	8 (3.4)
Physiotherapist	6 (2.5)
Dietician	4 (1.7)
Other non-clinical support	2 (0.8)
Occupational Therapist	1 (0.4)
Smoking Status	
Smoker	8 (3.4)
Non-smoker	188 (79.7)
Ex-smoker	32 (13.6)
Vulnerable Group†	
Yes	24 (10.2)

*University College Hospital
†As defined by Public Health England [https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people/]

Table 1: Demographics of respondents: Demographic data collected via survey from staff at University College Hospital London**.**

Known direct contact with SARS-CoV-2 positive patients was reported in 81 HCWs (34.3%) (Figure 1A), of which 24 (29.1%) of these were in appropriate personal protective equipment as perceived by respondents. Over half of those surveyed (128 respondents, 53.4%) were not aware of having had any direct contact with COVID-19 positive patients. Initial suspected cases were identified in mid-February and increased until late March 2020 (Figure 1B).

Clinical symptoms reported

Respondents were asked to report symptoms they experienced whilst unwell with an illness they perceived to be COVID-19. The number of respondents reporting each symptom is shown in Table 2.

The most reported symptoms included headache (78.8%), cough (75.8%), myalgia (63.6%) and fever (58.5%) (Table 2). Eighty-four respondents (35.6%) reported dyspnoea during their illness; of these 41 patients (17.4%) reported shortness of breath only on exertion. 12 patients (5.1%) reporting shortness of breath at rest. Nearly one third of HCWs experienced symptoms beyond 14 days (73 respondents, 30.9%).

To capture whether there were any particular symptoms early on in illness that occurred prior to the HCW beginning self-isolation, participants were asked retrospectively: “Do you recall any non-specific symptoms in the days prior to self-isolation? If so, please explain. (E.g. chills, malaise, fatigue, poor concentration, sleep disturbance)”. A number of those surveyed reported a prodromal syndrome prior to the appearance of the symptoms which met the Public health England criteria precipitating self-isolation. These included fatigue (92 respondents, 39.0%), chills (45 respondents, 24.3%) and headache (44 respondents, 23.8%), and anosmia (13 respondents) suggesting early non-specific and specific features prior to classical symptoms developing in HCWs.

Table 2. Symptoms reported during illness

Symptom During Self Isolation	**n=236 (%)**
Headache	186 (78.8)
Cough	179 (75.8)

Arthralgia/Myalgia	150 (63.6)
Fever/Chills	138 (58.5)
Pharyngitis	134 (56.8)
Coryzal Symptoms	117 (49.6)
Sleep Disturbance	99 (41.9)
Anosmia	97 (41.1)
Shortness of Breath	84 (35.6)
Diarrhoea	75 (31.8)
Anxiety	72 (30.5)
Chest Pain	65 (27.5)
Rash	13 (5.5)
Vomiting	10 (4.2)

Table 2: Retrospective recall of symptoms during illness

Dynamics and clustering of symptoms reported during illness

Fever persisted beyond 7 days in 15 respondents (Figure 2A). Almost all respondents reported headache, cough and/or myalgia) with only 9 individuals (3.8%) not reporting one of these symptoms. Correlation analysis of all symptoms did not demonstrate any clear symptom clusters except cough, shortness of breath and chest pain. Headache (49.6%), cough (45.8%) and myalgia (43.2%) were reported alongside fever to a similar extent (Figure 2B). Shortness of breath and chest pain were described by 17.4% (n=41) of respondents (Figure 2C).

A variety of neurological syndromes have been linked to COVID-19 [11]. In particular anosmia has been reported to be a specific indicator of COVID-19 disease [13]. Ninety-one respondents described anosmia during their illness (41.1%) and 13 reported anosmia prior to isolating guided by the PHE guidance at the time, which excluded anosmia as a symptom of COVID-19 (7.0%). Most individuals with anosmia also reported headache (Figure 2C). Onset of anosmia peaked at day 3-4 of illness with 84% reporting symptomatic resolution within 14 days (Figure 2D).

Healthcare seeking behaviour in HCWs

The most common medications taken during self-isolation are described in supplementary materials table 1. Respondents commonly sought advice regarding their illness informally (26.7%), via NHS 111 (25.4%) and general practice (7.6%). Two patients attended Accident and Emergency and required oxygen therapy during hospital admission.

A minority of respondents had access to monitoring of oxygen saturations during their illness, and of those who commented on saturation levels, 11 (4.7%) described saturations below 94% during their illness. Two respondents reported saturations below 85% either at rest or exertion. Only 41.7% of those with breathlessness at rest (n=12) and 44.2% of those who were breathless on exertion (n=43), sought formal medical advice (Figure 3A). Notably 9 respondents reported a combination of breathlessness and saturations less than 94% at rest; of these respondents half did not seek any formal healthcare advice (Figure 3B).

Chi Squared univariate analysis were performed to determine associations between symptoms and demographics and healthcare seeking behaviour. Formal healthcare seeking was defined as seeking assistance from NHS 111, GP or A&E services. Respondents reporting shortness of breath were significantly more likely to seek formal healthcare (p=0.008), whilst those reporting fever (p=0.614), cough (p=0.211) and chest pain (p=0.132) did not have increased rates of healthcare seeking. Age >50 (p=0.773) and sex (0.394) were not associated with rates of healthcare seeking.

Self-isolation and return to work

The majority of respondents (57.3%) did not feel able to effectively distance themselves from household members whilst unwell (as defined as access to a separate bedroom and/or toilet) (Figure 3C). Close contacts (defined as sharing a bed with symptomatic respondent on night prior to symptom onset) frequently became unwell during the 14 days after symptom onset of respondents (Figure 3C). Time to return to work varied in this cohort, with a significant number of respondents requiring greater than 7 days off work prior to return

(Figure 3D). Nine respondents required greater than 3 weeks off work (4.4%). In addition, 20% of respondents felt they returned to work before they felt ready.

Univariate Chi squared analyses were performed to determine association between symptoms and demographic factors and requirement to take > 7 days off work. There was not association between age (p=0.562) and/or gender (0.397) and absence from work beyond 7 days. Those reporting cough were significantly more likely to remain off work after 7 days (p=0.018), whilst there was a non-significant trend towards respondents with shortness (p=0.07) requiring greater than 7 days off work.

DISCUSSION:

This study collected early data on HCW illness during the peak of the COVID-19 pandemic at a major London teaching hospital. During the study period 984 staff were off with possible or confirmed COVID-19, and we describe 236 of these HCWs in this study. A previous study looking at HCW COVID-19 infection in the UK by Hunter et al [14] reported SARS-CoV2 positivity rates during a HCWs testing programme in March 2020. They found a steep rise in confirmed COVID-19 cases corresponding with the data we present on presumed infections. Whilst an important insight into the epidemiology of COVID-19 in HCWs, this previous study did not provide data on clinical presentation or behavioural aspects of HCW infection, and occupational data was not available for most participants. We therefore present novel data on HCW illness, healthcare seeking behaviour, self-isolation facilities, and return to work timelines of HCWs with presumed COVID-19 early in the UK Pandemic the peak of HCW.

This study adds to the literature around COVID-19 symptoms which should trigger self-isolation and diagnostic testing. In our study there was a significant proportion of this cohort reporting anosmia - 41.5%. This data supports the update to the PHE guidance including anosmia in the case definition [5], alongside several other studies collaborating these findings [15]. We also describe respondents reporting non-specific symptoms early in their illnesses prior to onset of self-isolation triggered by meeting the PHE case definition of COVID-19. We therefore suggest that the presence of sore throat and profound fatigue should prompt early staff testing of HCWs to minimize transmission of COVID-19 during the early infectious period.

We were concerned to find that HCWs fell ill at a high rate and for a prolonged period in this cohort. In this previously fit and well group of HCWs, a worrying proportion had SOB on minimal exertion and at rest (31/236) and 27.5% had chest pain. Furthermore, a significant minority remain unwell beyond 8 days and many have protracted illnesses beyond this. Protection of HCWs from COVID-19 infection should therefore be a priority to prevent the significant morbidity demonstrated by these respondents.

A particular further point of concern is that a significant proportion of healthcare workers did not seek formal medical advice or assessment despite significant shortness of breath, chest pain and/or hypoxia. Whilst statistical analysis did demonstrate that those respondents with shortness of breath were significantly more likely to seek formal medical assistance, there remained many respondents with breathlessness who did not seek medical attention. Several HCWs who reported significant breathlessness and measured hypoxia using home oximetry still did not seek formal medical attention. Consideration needs to be given as to how best to support patients isolating at home with this level of symptoms (utilising interventions such as telephone clinics and home oxygen saturation probes). Further analysis is also required to confirm whether late healthcare seeking by HCWs could lead to worse outcomes in terms of morbidity and mortality.

HCWs appear to lack the facilities to self-isolate effectively away from family member, which appeared to lead to significant numbers of close contacts of HCWs subsequently falling ill. Hospital trusts should consider provision of hospital accommodation for staff unwell with COVID-19 to minimise onward transmission to their home contacts; especially when household contacts of HCWs are in vulnerable groups.

The majority of staff were able to return to work after their presumed COVID-19 illness within one week a significant proportion were still febrile or did not feel well enough to come back to work until after day 10. This supports the change in guidance in the UK to stay at home for ten days. Indeed, 1 in 5 staff questioned in this survey felt they returned to work too soon. Statistical analysis demonstrated that that cough was the only significant predictor of requirement for taking time off work beyond five days. Staff members will therefore need support to ensure they are back to full health prior to returning to work and feel supported in this return and this could help inform occupational health and workforce management policy going forward.

There are several limitations to this study which are acknowledged by the authors.

The major limitation to this study was the lack of access to diagnostic swabs during staff illness, and inclusion was based on clinical criteria alone. This could potentially bias the study by including respondents with more mild respiratory viral infections. However it is worth noting firstly that the staff illness peak was temporally in keeping with the COVID-19 outbreak across London. Furthermore, data from the SAFER study, a swabbing and sero-prevalence study at the same hospital site, found very high rates of positive SARS-CoV2 PCR positivity and seroconversion rates during the study period. Specifically, within the hospital at which our study was based, 20% of frontline staff were already seropositive at the end of March when our survey opened; rising to 45% seropositivity by the end of April 2020 [2]. It is therefore felt highly likely that significant numbers of staff included in this survey would have illness caused by COVID-19.

The second limitation of the study was the possibility that the use of a voluntary online survey to collect data has several sources of bias. It is unlikely that every self-isolating HCW was captured by this approach and we suspect that our sample over-represents the number of training grade doctors in our sample given that 33.9% of the survey population were doctors. Overall this may lead to an overrepresentation of those in patient facing roles, leading to overestimation of infection rates. Conversely it is feasible that reduced participation of other HCWs such as porters, cleaners, and domestics, likely to be at high risk of exposure may bias the study in the opposite way. Further investigation will be required to clarify this important point.

The third potential limitation is the potential for selection bias caused by the requirement for participants to have access to the internet, receive and read email lists, and be well enough to complete the survey. This final point is important as very unwell patients or those who died would be missed by our analysis. Therefore, severe COVID-19 illness in HCW is likely to be under-represented in our sample due to selection bias.

In summary this study highlights the importance of anosmia as a symptom in early course of illness enabling differentiation of COVID-19 from other upper respiratory tract illnesses. Secondly this study demonstrates that a significant proportion of HCWs had prolonged febrile illnesses and prolonged absences from work. This should inform human resource management and support services for staff, as well as supporting the change in guidance in the UK to stay a home and self-isolate for 10 days. The worrying proportion of HCWs who were previously fit and well and went on to developed significant shortness and chest pain is of concern. We would suggest HCWs are provided with support such as telephone clinics, and access to pulse oximeters to support them during their illness and arrange admission as required. Finally, hospital trusts should urgently address issues raised regarding delayed healthcare seeking in staff with hypoxia and severe breathlessness that this study highlighted.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. **(b)** Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

Figure 2: Duration of reported fever in self isolating healthcare workers (A); symptom clustering reported during illness (B, C); and characterisation of anosmia (D) (a) respondents were asked to report the duration of their fever. The majority of respondents reported fever duration less than 7 days (n=110, 88). Fever persisted to 7 days or more in 12% (n=15 **(b)** Proportional Venn diagrams (generated using BioVenn[2]) demonstrating the crossover between fever (reported by 58.5% of respondents) and the three most commonly reported symptoms – headache, cough and myalgia. Grey circles demonstrate the denominator (all respondents), light red circles show respondents reporting fever and burgundy circles show respondent reporting other symptoms. Percentages in white show the proportion of the overall group of respondents reporting both fever and the relevant second symptom.**(c)** Proportional Venn diagrams (generated using BioVenn[2]) demonstrating the crossover between shortness of breath & chest pain, and headache & anosmia. Grey circles demonstrate the denominator (all respondents). Percentages in white show the proportion of the overall group of

respondents reporting both symptoms in each Venn. **(d)** Respondents reporting anosmia (n=91, 41.1%) were asked the day of onset and duration of this symptom. The majority of respondents developed anosmia early in illness (median day 3, SD 1.96) and had resolution of anosmia within 2 weeks of its onset (n=75, 84%).

Figure 3: Healthcare seeking behaviour as triggered by breathlessness in HCWs (A); Access to self-isolation facilities (B); illness in close contacts of HCWs (C); return to work timeline (D). (a) 84 respondents reported breathlessness (35.6%); increased severity of breathless did not appear to lead to increased formal healthcare seeking in respondents. Of those respondents reporting breathlessness at rest (n=12), only 41.7% (n=5/12), sought formal medical attention (NHS 111, GP, A&E) (b) 9 respondents reported a combination of breathlessness and saturations of <94% (measured using home oximeters). A majority (n=5/9) of those respondents sought either no or informal advice only. (c) Respondents were asked if they felt able to self-isolate away from other household members (separate bedroom, bathroom). A majority did not feel able to self-isolate in this way (n= 126, 57.27%). (d) Respondents were asked whether their partner became unwell (phrased as 'sharing bed on night of symptom onset') during 14 days after symptom onset. A majority (n=125, 61.13%) reported their partners did become unwell during this period.

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Contributorship statement: ADW and SL conceived of the presented idea. ADW, SL, EK, ZC, LB contributed to study design. SL and JC led on distribution of survey. Data collection and analysis were performed by ADW, SL, EK, ZC, LB, JG, JC, RL.. ADW led writing the initial manuscript draft. SL and JC led on distribution of survey. ADW, SL, EK, ZC, LB, JG, JC, RL reviewed, edited and finalised the manuscript, providing critical feedback and changes prior to submission, The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Data availability statement:
Data available on reasonable request, communications to corresponding author angus.dewilton@nhs.net; requests will be responded to within 28 days

Exclusive licence statement

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Figure 1

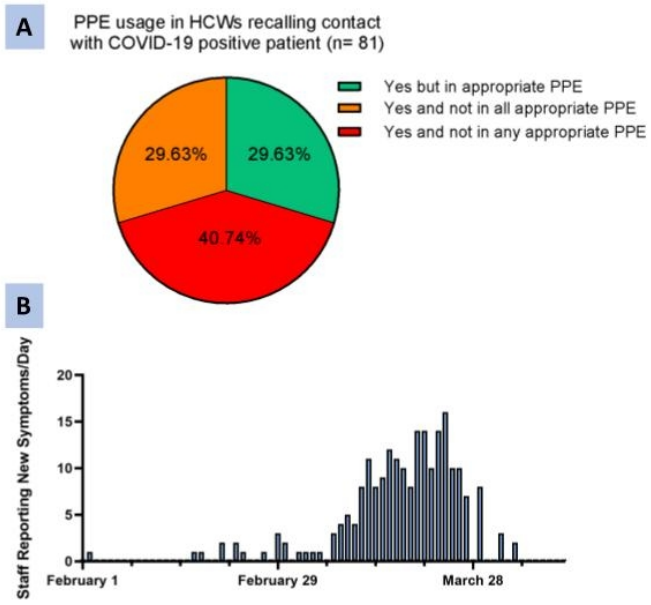

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. **(a)** 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. Figure shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. **(b)** Respondents were asked to report their first day of symptom onset. Chart shows day of onset on illness.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. (b) Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

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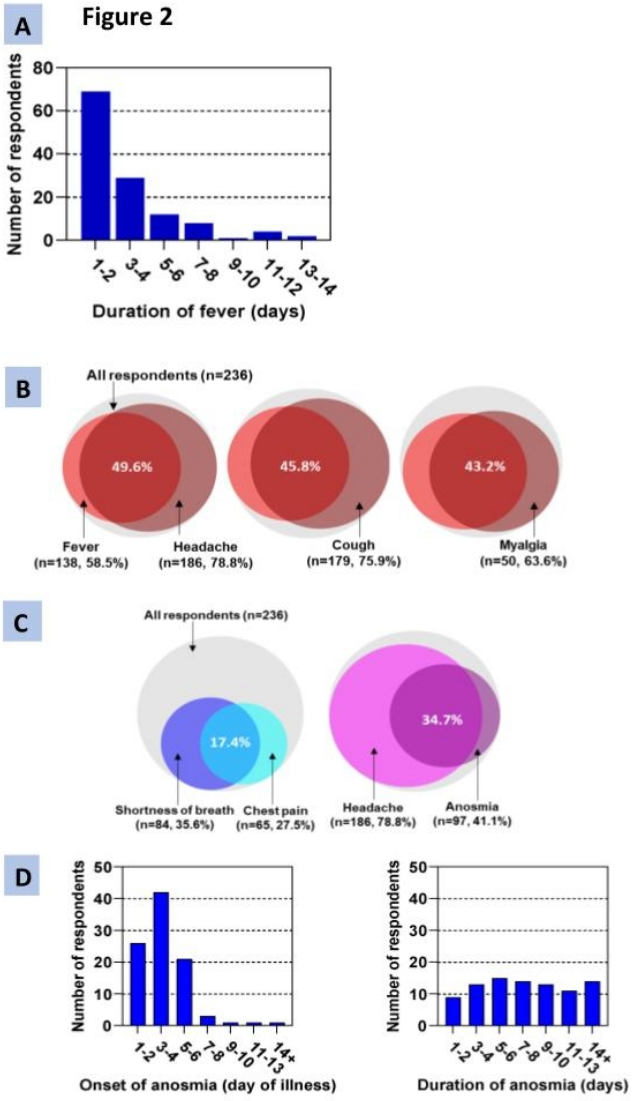

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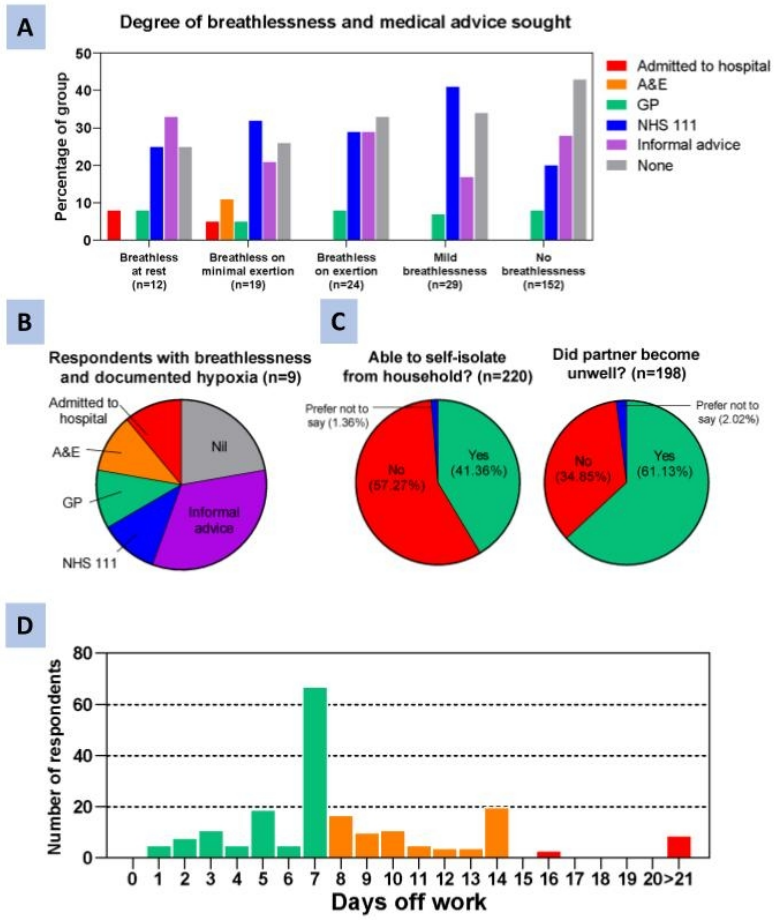
Figure 3



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254x366mm (72 x 72 DPI)

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

Health Care Worker (HCW) Data Collection Sheet; Symptoms during Self Isolation

Background:
During the current COVID-19 outbreak current NHS guidelines are for healthcare workers to to self isolate for 7 days from symptom onset, providing fever has settled for 48 hours prior to return to work. Anecdotally we have observed prolonged illnesses in HCWs and return to work can be delayed due to this. More information is needed regarding duration and range of symptoms in Covid 19 illness in the context of HCWs.

Aim:
We aim to gather basic information from HCWs who have self isolated with acute febrile and/or respiratory illnesses during the recent weeks. Information included will be background information, duration and presence of symptoms, location of care and return to work timeline.

Methods:
We will undertake an anonymous survey of self reported symptoms of HCWs. Attached is the questionnaire. Of note we will collect minimal personal details of participants to ensure participants remain non identifiable even when information is combined.

Inclusion:
This questionnaire should be completed by HCWs who have self isolated with fever and/or persistent cough and have been off work since March 1st. Testing for Covid 19 is not currently routine so this is not a requirement.

Guidance:
Please read and complete as much of the attached survey as you are happy and able to. Please indicate below if you consent to your personal data being processed and managed as outlined in the privacy policy.

Survey point of contact:
Dr Angus de Wilton, Internal Medicine Trainee UCLH
Please email questions or queries to: angus.dewilton@nhs.net

If there are sections of the questionnaire you do not wish to complete please leave these blank.

You have the right to remove your data from this survey at any time. If you wish to withdraw your data, please email angus.dewilton@nhs.net and you will receive a reply within 30 days.

This questionnaire should take approximately no longer than 15 minutes. We appreciate your time.

I confirm I have read and understand the above information regarding the survey and have contact details of study investigation should I wish to ask further questions prior to participation *

☐ I consent

I have read any understood the privacy policy and consent to my data being processed, collected and utilised as described in this policy *

☐ I consent

I understand I am completing a voluntary survey and can withdraw at any time, without providing any reason and without my legal rights being affected *

☐ I consent

I consent to the information being distributed to third parties for the purpose of public health and research purposes in the futures, inside of the EEA *

☐ I consent

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

ABOUT YOU

What is your age

Please select...

What is your sex?

Please select...

Which trust do you currently work for?

Please select...

Is your main place of work?

Please select...

What is your role?

Please select...

Smoking Status

- ☐ Current Smoker > 20 a day
- ☐ Current Smoker <20 a day
- ☐ Ex smoker
- ☐ Non smoker
- ☐ Smoker of other substance (e.g.marijuana)

Are you in a 'Vulnerable Group' as per Public Health England guidelines?
These include age over 70, or age under 70 who would otherwise be advised to get a flu jab (see link for full list), or pregnant. Click here for the full list.

○ Yes ○ No ○ Unsure ○ I do not wish to disclose

Symptoms during Self Isolation; Health Care Worker (HCW) Survey Page 2 of 2

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Your Rights Under GDPR

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

EXPOSURES

Did you have contacted with patient(s) positive for Covid-19 during the 14 days prior to symptoms?

Please select...

Did you perform any aerosol generating procedures with Covid 19 positive patients in 14 days prior to symptom onset? Click here for more details.

Please select...

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Your Rights Under GDPR

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

SYMPTOMS

What day did your symptoms begin?

Please select...

Do/ Did you have a fever?

Please select...

Do you recall any non specific symptoms in the days prior to self isolation? If so, please explain. *(eg chills, malaise, fatigue, poor concentration, sleep disturbance)*

Did you have any symptoms lasting > 14 day

○ Yes ○ No

Which day did your symptoms peak? This is the day when symptoms most bothered you or disrupted your life.

Please select...

SPECIFIC SYMPTOMS

	Yes	No
Anosmia (loss of smell)	○	○
Anxiety	○	○
Chest Pain	○	○

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

	Yes	No
Coryzal Symptoms (runny nose, sneezing)	○	○
Cough	○	○
Diarrhea	○	○
Fever	○	○
Headache	○	○
Joint Pains/Myalgia	○	○
Rash	○	○
Sleep Disturbance	○	○
Shortness of Breath	○	○
Sore Throat	○	○
Vomiting	○	○

How would you describe your cough?

Please select...

Please comment on any other symptoms you experienced

Symptom Diary - if you are able to provide a more detailed description of your illness and how it progressed day to day, please provide that here.

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

MEDICAL ASSISTANCE

Were you tested for Covid-19 during your illness?

Please select...

Did you have access to any monitoring, which you used during your illness?

○ Yes ○ No

(examples: thermometer, blood pressure monitoring, pulse oximetry)

Did you take any medications during your illness:

☐ Antibiotics ☐ Codeine ☐ Herbal Remedies

☐ Ibuprofen/Naproxen ☐ Inhalers ☐ Paracetamol

☐ Phenylephrine ☐ Steroids ☐ Other

Please provide details of your answer above (eg duration of admission)

Did you seek/require medical assistance from any of the following:

Please select...

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

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Please provide any other comments on health care seeking during your illness

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

RETURN TO WORK

What day did you return to work (if you required further absence please choose the first date of returning to work)?

Please select...

How many days were you off work in total?

Please select...

Did you feel ready to return to work when you did?

- ○ Yes
- ○ No

Did you require more time off work after your 7 day period of isolation?

- ○ Yes
- ○ No

Were you able to work at all from home during self isolation

Please select...

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

HOME CONTACTS

How many people do you share a home with?

Please select...

If you were sharing a bed with a partner on day of symptom onset, did they become unwell during the following 14 days?

○ Yes ○ No ○ Prefer not to say

Were you able to isolate away from home contacts whilst symptoms?

○ Yes ○ No ○ Prefer not to say

(eg: own toilet, own room, etc.)

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Supplementary Table 1. Summary of medications that respondents report taking during self-isolation

Medication	n=236 (%)
Paracetamol	195 (82.6%)
NSAIDs	33 (14.0%)
Herbal	20 (8.5%)
Phenylephrine	19 (8.1%)
Inhaler	17 (7.2%)
Antibiotics	15 (6.4%)
Codeine	10 (4.2%)
Steroid	7 (3.0%)
Other	20 (8.5%)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1
Objectives	3	State specific objectives, including any prespecified hypotheses	1
Methods			
Study design	4	Present key elements of study design early in the paper	2
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	2
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	2
Study size	10	Explain how the study size was arrived at	3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	2-3
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	N/A
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	2
		(b) Give reasons for non-participation at each stage	2
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	3
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	2-3
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	3-4
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	4
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	3-4
Generalisability	21	Discuss the generalisability (external validity) of the study results	4
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Delayed healthcare seeking and prolonged illness in healthcare workers during the COVID-19 pandemic: a single-centre observational study

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Delayed healthcare seeking and prolonged illness in healthcare workers during the COVID-19 pandemic: a single-centre observational study

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MeSH Keywords: COVID-19, Secondary Care, Cross-Sectional Studies, Health Personnel, Olfaction Disorders

ABSTRACT:

Objectives: To describe a cohort of self-isolating healthcare workers (HCWs) with presumed COVID-19.

Design: A cross-sectional, single-centre study.

Setting: A large, teaching hospital based in Central London with tertiary infection services.

Participants: 236 HCWs completed a survey distributed by internal staff email bulletin. 167 were female and 65 male.

Measures: Information on symptomatology, exposures and health-seeking behaviour were collected from participants by self-report.

Results: The 236 respondents reported illness compatible with COVID-19 and there was an increase in illness reporting during March 2020. Diagnostic swabs were not routinely performed. Cough (n=179, 75.8%), fever (n=138, 58.5%), breathlessness (n=84, 35.6%) were reported. Anosmia was reported in 42.2%. Fever generally settled within 1 week (n=110/138, 88%). Several respondents remained at home and did not seek formal medical attention despite reporting severe breathlessness and measuring hypoxia (n=5/9, 55.6%). 2 patients required hospital admission but recovered following oxygen therapy. 84 respondents (41.2%) required greater than the obligated 7 days off work and 9 required greater than 3 weeks off.

Conclusion: There was a significant increase in staff reporting illness compatible with possible COVID-19 during March 2020**.** Subsequent serology studies at the same hospital study site have confirmed sero-positivity for COVID-19 up to 45% by the end of April 2020 in frontline HCWs. The study revealed a concerning lack of healthcare seeking in respondents with significant red flag symptoms (severe breathlessness, hypoxia), and highlighted anosmia as a key symptom of COVID-19.

Strengths and limitations of this study:

- This study describes a large cohort of self-reported healthcare worker (HCW) COVID-19 illness during the peak of the COVID-19 pandemic in London.
- Study respondents represented a broad range of job roles, including both frontline clinical and non-patient facing staff in a hospital setting proven to have high incidence of COVID-19 infection during the study period
- The inclusion of questions focusing on health-seeking behaviour allows results to be used to inform human resource management in the developing pandemic, and provides concerning but important data around late healthcare seeking in HCWs
- Limitations include the use of a self-reported, cross-sectional and retrospective survey, which may be subject to recall bias.
- The lack of diagnostic PCR availability somewhat limits interpretation, although later serological studies have shown high COVID-19 infection rates at the study hospital

BACKGROUND:

In response to the COVID-19 pandemic, the UK government enacted a range of policies to limit the spread of infection. These included guidelines on self-isolation for symptomatic individuals and a formal social distancing policy [1]. Healthcare workers (HCWs) are at a disproportionate risk for COVID-19 disease through occupational exposure [2]. Additionally, there are emerging concerns that HCWs may be at an additional risk of developing severe disease through repeated exposure to high viral loads in the clinical environment [3]. This has implications for workforce planning and operational preparedness in the current crisis.

At the time of the study, SARS-CoV-2 testing was not routinely available for UK HCWs. Instead, HCWs fitting the Public health England (PHE) case definition for COVID-19 infection (persistent cough, fever) were advised to self-isolate for a minimum of 7 days from the onset of symptoms and return to work after this period if symptoms free [4]. Governmental websites advised seeking formal medical attention only if difficulty breathing developed; this was later updated to any deterioration or failure to improve [5]. Avenues of medical advice open to patients in the UK include NHS 111, a free online and telephone triage and advice system; the patient's own general practitioner (GP); and Accident and Emergency (A&E) departments in secondary care. These resources are in addition to informal health advice provided by friends, family, or colleagues. Little is currently described about healthcare seeking behaviour in HCWs during the COVID-19 pandemic.

Several symptoms have been described in individuals with suspected and confirmed COVID-19, including fever, cough and shortness of breath [6,7] and anosmia, with few detailed studies looking specifically at HCW illness [8,9], and none specifically focusing on healthcare seeking in this cohort.

In this study we describe the experiences and symptoms of HCWs self-isolating for presumed COVID-19 infection in a cohort of frontline HCWs in a central London teaching hospital known to have very high levels of staff COVID-19 infection [2]. We aim to examine the healthcare seeking behaviours in this unique cohort.

METHODS:

We performed a cross sectional, single-centre study of NHS HCWs who self-isolated with symptoms compatible with COVID-19 during the early COVID-19 pandemic. The study was designed as a survey based cross sectional study of HCWs unwell early in the pandemic. The study setting was University College London Hospitals NHS Foundation Trust. Eligibility criteria were: current employment at University College London Hospitals NHS Foundation Trust, and haven undertaken self-isolation since March 1st with either a fever or persistent cough as per the PHE guidelines for HCWs. Participants were recruited via staff email bulletin to all staff departments. Patients and public were not recruited to the study. Participants were asked to report potential exposures to COVID-19, access to personal protective equipment (PPE), variety and duration of

symptoms, occupational health data and healthcare seeking behaviours. Data sources were by self-reported survey (supplementary file) and the study did not obtain access to medical records of participants. The study size was determined by the number of respondents during the survey window, with reminder emails sent regularly. The study team attempted to reduce selection bias by circulating the email survey to as many departments as possible, and attempting to recruit from both clinical and non-clinical settings. The survey was open between 1st April and 10th April 2020. Consent was obtained via electronic signature. Responses were devoid of personal identifiers and were collected and processed via Form Assembly Enterprise cloud https://www.formassembly.com/. All data was stored in compliance with the General Data Protection Regulation (EU GDPR 2016/679) and Data Protection Act (UK 2018). The Study was approved by the Audit and Research Committee at the Hospital of Tropical Diseases, UCLH [10]. Anonymous data was exported to Microsoft Excel 2010 (Microsoft Corporation) and R (R Development Core Team 2008) for analysis. Chi Squared univariate analyses were performed using R to determine association between patient factors and duration of time off work, and healthcare seeking behaviour. The majority of data was presented in a descriptive fashion. Venn diagrams were generated using Venny 2.1.0 (https://bioinfogp.cnb.csic.es/tools/venny/) [11] and BioVenn (https://www.biovenn.nl/) [12] to describe overlap of symptom clusters.

Patient and Public involvement

This study involved NHS staff members only and did not recruit from the general public or NHS patient population. Results will be disseminated to staff via email bulletin.

RESULTS:

Demographics, timeline and exposure history

During the study period 984 staff were recorded as being off work with confirmed or possible COVID-19 at the study site, of which 236 responded to our survey. Of the 236 respondents to the survey 167 (70.8%) were female and 27.5% male (Table 1). Respondents were aged between 18 and 71. The respondents were from a broad range of hospital roles with the most common groups being doctors (33.5%) and nurses (25.4%). There was a broad range of other professions represented. The majority were non-smokers (79.7%), with 32 (13.6%) ex-smokers and eight current smokers (3.4%). Twenty-four respondents (10.2%) reported being in a vulnerable group according to Public Health England criteria [1].

Table 1. Demographics of respondents

Demographic	**n=236 (%)**
Sex	
Female	167 (70.8)
Age	
18-28	53 (22.5)
29-39	88 (37.3)
40-50	66 (28.0)
50-60	21 (8.9)
61-71	3 (1.3)
Workplace	
UCH*	229 (97.0)
Other	4 (1.7)
Hospital	228 (96.6)
Community	5 (2.1)
Job Role	
Doctor	79 (33.5)
Nurse	60 (25.4)
Administrator	18 (7.6)
Other	17 (7.2)
Other allied healthcare professional	17 (7.2)
Radiographer	14 (5.9)
Manager	9 (3.8)

Healthcare assistant	8 (3.4)
Physiotherapist	6 (2.5)
Dietician	4 (1.7)
Other non-clinical support	2 (0.8)
Occupational Therapist	1 (0.4)
Smoking Status	
Smoker	8 (3.4)
Non-smoker	188 (79.7)
Ex-smoker	32 (13.6)
Vulnerable Group†	
Yes	24 (10.2)

*University College Hospital

†As defined by Public Health England [https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people/]

Table 1: Demographics of respondents: Demographic data collected via survey from staff at University College Hospital London**.**

Known direct contact with SARS-CoV-2 positive patients was reported in 81 HCWs (34.3%) (Figure 1A), of which 24 (29.1%) of these were in appropriate personal protective equipment as perceived by respondents. Over half of those surveyed (128 respondents, 53.4%) were not aware of having had any direct contact with COVID-19 positive patients. Initial suspected cases were identified in mid-February and increased until late March 2020 (Figure 1B).

Respondents were asked to report symptoms they experienced whilst unwell with an illness they perceived to be COVID-19. The number of respondents reporting each symptom is shown in Table 2. The most reported symptoms included headache (78.8%), cough (75.8%), myalgia (63.6%) and fever (58.5%) (Table 2). Eighty-four respondents (35.6%) reported dyspnoea during their illness; of these 41 patients (17.4%) reported shortness of breath only on exertion. 12 patients (5.1%) reporting shortness of breath at rest. Nearly one third of HCWs experienced symptoms beyond 14 days (73 respondents, 30.9%).

Table 2. Symptoms reported during illness

Symptom During Self Isolation	**n=236 (%)**
Headache	186 (78.8)
Cough	179 (75.8)
Arthralgia/Myalgia	150 (63.6)
Fever/Chills	138 (58.5)
Pharyngitis	134 (56.8)
Coryzal Symptoms	117 (49.6)
Sleep Disturbance	99 (41.9)
Anosmia	97 (41.1)
Shortness of Breath	84 (35.6)
Diarrhoea	75 (31.8)
Anxiety	72 (30.5)
Chest Pain	65 (27.5)
Rash	13 (5.5)
Vomiting	10 (4.2)

Table 2: Retrospective recall of symptoms during illness

Healthcare seeking behaviour in HCWs

The most commonly reported mode of healthcare seeking during illness were informal advice (26.7%), NHS 111 (25.4%) and general practice (7.6%). Two patients attended Accident and Emergency and required oxygen therapy during hospital admission.

A minority of respondents had access to monitoring of oxygen saturations during their illness, and of those who commented on saturation levels, 11 (4.7%) described saturations below 94% during their illness. Two respondents reported saturations below 85% either at rest or exertion. Only 41.7% of those with breathlessness at rest (n=12) and 44.2% of those who were breathless on exertion (n=43), sought formal medical advice (Figure 2A). Notably 9 respondents reported a combination of breathlessness and saturations less than 94% at rest; of these respondents half did not seek any formal healthcare advice (Figure 2B).

Chi Squared univariate analysis were performed to determine associations between symptoms and demographics and healthcare seeking behaviour. Formal healthcare seeking was defined as seeking assistance from NHS 111, GP or A&E services. Respondents reporting shortness of breath were significantly more likely to seek formal healthcare (p=0.008), whilst those reporting fever (p=0.614), cough (p=0.211) and chest pain (p=0.132) did not have increased rates of healthcare seeking. Age >50 (p=0.773) and sex (0.394) were not associated with rates of healthcare seeking.

The most common medications taken during self-isolation are described in supplementary materials table 1.

Self-isolation and return to work

The majority of respondents (57.3%) did not feel able to effectively distance themselves from household members whilst unwell (as defined as access to a separate bedroom and/or toilet) (Figure 2C). Close contacts (defined as sharing a bed with symptomatic respondent on night prior to symptom onset) frequently became unwell during the 14 days after symptom onset of respondents (Figure 2C). Time to return to work varied in this cohort, with a significant number of respondents requiring greater than 7 days off work prior to return (Figure 2D). Nine respondents required greater than 3 weeks off work (4.4%). In addition, 20% of respondents felt they returned to work before they felt ready.

Univariate Chi squared analyses were performed to determine association between symptoms and demographic factors and requirement to take > 7 days off work. There was not association between age (p=0.562) and/or gender (0.397) and absence from work beyond 7 days. Those reporting cough were significantly more likely to remain off work after 7 days (p=0.018), whilst there was a non-significant trend towards respondents with shortness of breath(p=0.07) requiring greater than 7 days off work.

Persistent symptoms and neurological symptoms

Fever persisted beyond 7 days in 15 respondents (Figure 3A). Almost all respondents reported headache, cough and/or myalgia) with only 9 individuals (3.8%) not reporting one of these symptoms

A variety of neurological syndromes have been linked to COVID-19; in particular anosmia [13]. Ninety-one respondents described anosmia during their illness (41.1%) and 13 reported anosmia prior to isolating guided by the PHE guidance at the time, which excluded anosmia as a symptom of COVID-19 (7.0%). Most individuals with anosmia also reported headache (Figure 3B). Onset of anosmia peaked at day 3-4 of illness with 84% reporting symptomatic resolution within 14 days (Figure 3C).

DISCUSSION:

This study collected early data on HCW illness during the peak of the COVID-19 pandemic at a major London teaching hospital. During the study period 984 staff were off work with possible or confirmed COVID-19, and we describe 236 of these HCWs in this study. This study was unique in capturing data on healthcare seeking behaviour, self-isolation facilities, and return to work timelines of HCWs with presumed COVID-19 early in the UK Pandemic.

We were concerned to find that HCWs fell ill at a high rate and at times for a prolonged period in this cohort. In this previously fit and well group of HCWs, a worrying proportion had shortness of breath on minimal exertion and at rest (31/236) and 27.5% had chest pain. Furthermore, a significant minority remained unwell beyond 8 days and many have protracted illnesses beyond this. Prolonged symptoms were not predicted by age or sex, demonstrating the unpredictable nature of COVID-19 in even a generally young, fit and healthy cohort. Protection of HCWs from COVID-19 infection should therefore be a priority to prevent the significant morbidity demonstrated by these findings.

A further point of concern raised by this study is that a significant proportion of healthcare workers did not seek formal medical advice or assessment despite significant red flag symptoms of shortness of breath or chest pain, and in some cases despite even measured hypoxia at home. Consideration needs to be given as to how best to support patients isolating at home with this level of symptoms (utilising interventions such as telephone clinics and home oxygen saturation probes) to prevent risk of deterioration and mortality in this population.

This study adds to the literature around COVID-19 symptoms which should trigger self-isolation and diagnostic testing. In our study there was a significant proportion of this cohort reporting anosmia - 41.5%. This data supports the update to the PHE guidance including anosmia in the case definition [5], alongside several other studies collaborating these findings [14].

There are several limitations to this study which are acknowledged by the authors.

The major limitation to this study was the lack of access to diagnostic swabs during staff illness, and inclusion was based on clinical criteria alone. This could potentially bias the study by including respondents with more mild respiratory viral infections. However it is worth noting firstly that the staff illness peak was temporally in keeping with the COVID-19 outbreak across London. Furthermore, data from the SAFER study, a swabbing and sero-prevalence study at the same hospital site, found very high rates of positive SARS-CoV2 PCR positivity and seroconversion rates during the study period. Specifically, within the hospital at which our study was based, 20% of frontline staff were already seropositive at the end of March when our survey opened; rising to 45% seropositivity by the end of April 2020 [2]. It is therefore felt highly likely that significant numbers of staff included in this survey would have illness caused by COVID-19.

The second limitation of the study was the possibility that the use of a voluntary online survey to collect data has several sources of bias. It is unlikely that every self-isolating HCW was captured by this approach and we suspect that our sample over-represents the number of training grade doctors in our sample given that 33.9% of the survey population were doctors. Overall this may lead to an overrepresentation of those in patient facing roles, leading to overestimation of infection rates. Conversely it is feasible that reduced participation of other HCWs such as porters, cleaners, and domestics, likely to be at high risk of exposure may bias the study in the opposite way. Further investigation will be required to clarify this important point.

The third potential limitation is the potential for selection bias caused by the requirement for participants to have access to the internet, receive and read email lists, and be well enough to complete the survey. This final point is important as very unwell patients or those who died would be missed by our analysis. Therefore, severe COVID-19 illness in HCW is likely to be under-represented in our sample due to selection bias.

In summary, this study found a worrying proportion of HCWs who were previously fit and well went on to developed significant shortness of breath and chest pain, as well as significant morbidity from prolonged illnesses. There is evidence of late healthcare seeking in these HCWs. We would therefore suggest HCWs are provided with support such as telephone clinics, and access to pulse oximeters to support them during their illness. Furthermore this study reinforces the importance of anosmia as a symptom in early course of illness enabling differentiation of COVID-19 from other upper respiratory tract illnesses.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they

considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. **(b)** Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

Figure 2: Healthcare seeking behaviour as triggered by breathlessness in HCWs (A); Access to self-isolation facilities (B); illness in close contacts of HCWs (C); return to work timeline (D). (a) 84 respondents reported breathlessness (35.6%); increased severity of breathless did not appear to lead to increased formal healthcare seeking in respondents. Of those respondents reporting breathlessness at rest (n=12), only 41.7% (n=5/12), sought formal medical attention (NHS 111, GP, A&E) (b) 9 respondents reported a combination of breathlessness and saturations of <94% (measured using home oximeters). A majority (n=5/9) of those respondents sought either no or informal advice only. (c) Respondents were asked if they felt able to self-isolate away from other household members (separate bedroom, bathroom). A majority did not feel able to self-isolate in this way (n= 126, 57.27%). (d) Respondents were asked whether their partner became unwell (phrased as 'sharing bed on night of symptom onset') during 14 days after symptom onset. A majority (n=125, 61.13%) reported their partners did become unwell during this period.

Figure 3: Duration of reported fever in self isolating healthcare workers (A); clustering of headache and anosmia; and characterisation of anosmia (C) (a) respondents were asked to report the duration of their fever. The majority of respondents reported fever duration less than 7 days (n=110, 88). Fever persisted to 7 days or more in 12% (n=15 (b) Proportional Venn diagrams (generated using BioVenn2) demonstrating the crossover between headache & anosmia. Grey circles demonstrate the denominator (all respondents). Percentages in white show the proportion of the overall group of respondents reporting both symptoms in each Venn **(c)**Respondents reporting anosmia (n=91, 41.1%) were asked the day of onset and duration of this symptom. The majority of respondents developed anosmia early in illness (median day 3, SD 1.96) and had resolution of anosmia within 2 weeks of its onset (n=75, 84%).

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Contributorship statement: ADW and SL conceived of the presented idea. ADW, SL, EK, ZC, LB contributed to study design. SL and JC led on distribution of survey. Data collection and analysis were performed by ADW, SL, EK, ZC, LB, JG, JC, RL.. ADW led writing the initial manuscript draft. SL and JC led on distribution of survey. ADW, SL, EK, ZC, LB, JG, JC, RL reviewed, edited and finalised the manuscript, providing critical feedback and changes prior to submission, The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Data availability statement:
Data available on reasonable request, communications to corresponding author angus.dewilton@nhs.net; requests will be responded to within 28 days

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Figure 1

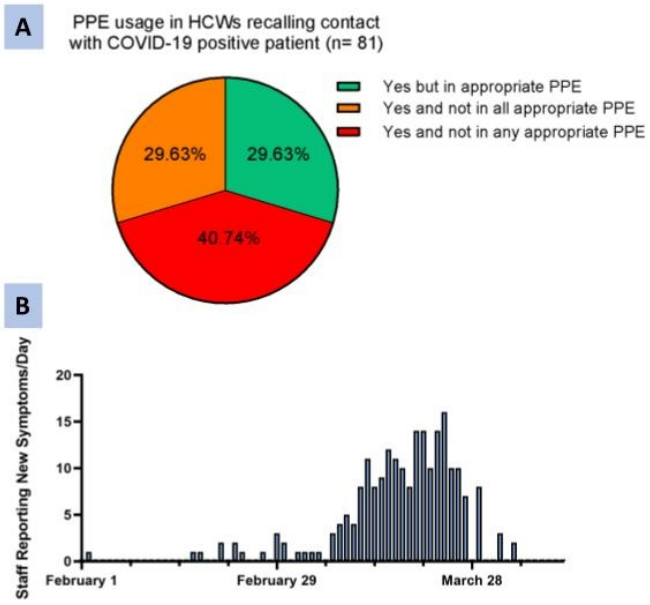

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. **(a)** 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. Figure shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. **(b)** Respondents were asked to report their first day of symptom onset. Chart shows day of onset on illness.

Figure 1: Self-perceived PPE usage and date of symptom onset in healthcare workers. (a) 81 of 236 respondents reported an exposure to a patient who was confirmed or subsequently confirmed to be SARS-CoV-2 positive. The pie chart shows the breakdown of responses in this group when asked whether they considered that they were wearing appropriate PPE, partly appropriate PPE or no appropriate PPE at the time of this exposure. 40.74% of respondents in this group (n=33, 13.98% of overall cohort) reported they considered that they were not wearing any appropriate PPE at the time of exposure. (b) Respondents were asked to report their first day of symptom onset. Most reported symptom onset occurring within the first 3 weeks of March 2020.

254x366mm (72 x 72 DPI)

Figure 2

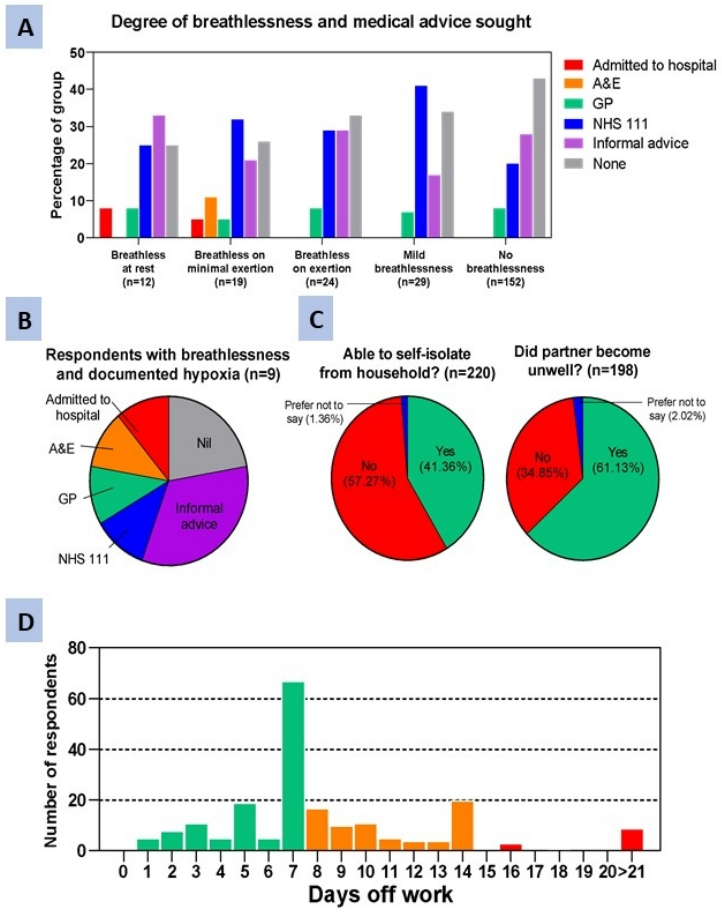

Figure 2: Healthcare seeking behaviour as triggered by breathlessness in HCWs (A); Access to self-isolation facilities (B); illness in close contacts of HCWs (C); return to work timeline (D). (a) 84 respondents reported breathlessness (35.6%); increased severity of breathless did not appear to lead to increased formal healthcare seeking in respondents. Of those respondents reporting breathlessness at rest (n=12), only 41.7% (n=5/12), sought formal medical attention (NHS 111, GP, A&E) (b) 9 respondents reported a combination of breathlessness and saturations of <94% (measured using home oximeters). A majority (n=5/9) of those respondents sought either no or informal advice only. (c) Respondents were asked if they felt able to self-isolate away from other household members (separate bedroom, bathroom). A majority did not feel able to self-isolate in this way (n= 126, 57.27%). (d) Respondents were asked whether their partner became unwell (phrased as 'sharing bed on night of symptom onset') during 14 days after symptom onset. A majority (n=125, 61.13%) reported their partners did become unwell during this period.

190x275mm (96 x 96 DPI)

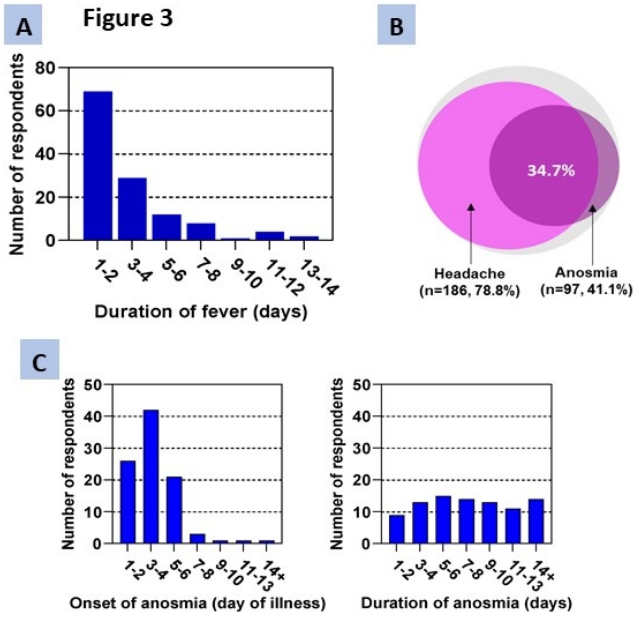

Figure 3: Duration of reported fever in self isolating healthcare workers (A); clustering of headache and anosmia; and characterisation of anosmia (C) (a) respondents were asked to report the duration of their fever. The majority of respondents reported fever duration less than 7 days (n=110, 88). Fever persisted to 7 days or more in 12% (n=15 (b) Proportional Venn diagrams (generated using BioVenn2) demonstrating the crossover between headache & anosmia. Grey circles demonstrate the denominator (all respondents). Percentages in white show the proportion of the overall group of respondents reporting both symptoms in each Venn (c)Respondents reporting anosmia (n=91, 41.1%) were asked the day of onset and duration of this symptom. The majority of respondents developed anosmia early in illness (median day 3, SD 1.96) and had resolution of anosmia within 2 weeks of its onset (n=75, 84%).

190x275mm (96 x 96 DPI)

Supplementary Table 1. Summary of medications that respondents report taking during self-isolation

Medication	n=236 (%)
Paracetamol	195 (82.6%)
NSAIDs	33 (14.0%)
Herbal	20 (8.5%)
Phenylephrine	19 (8.1%)
Inhaler	17 (7.2%)
Antibiotics	15 (6.4%)
Codeine	10 (4.2%)
Steroid	7 (3.0%)
Other	20 (8.5%)

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

Health Care Worker (HCW) Data Collection Sheet; Symptoms during Self Isolation

Background:
During the current COVID-19 outbreak current NHS guidelines are for healthcare workers to to self isolate for 7 days from symptom onset, providing fever has settled for 48 hours prior to return to work. Anecdotally we have observed prolonged illnesses in HCWs and return to work can be delayed due to this. More information is needed regarding duration and range of symptoms in Covid 19 illness in the context of HCWs.

Aim:
We aim to gather basic information from HCWs who have self isolated with acute febrile and/or respiratory illnesses during the recent weeks. Information included will be background information, duration and presence of symptoms, location of care and return to work timeline.

Methods:
We will undertake an anonymous survey of self reported symptoms of HCWs. Attached is the questionnaire. Of note we will collect minimal personal details of participants to ensure participants remain non identifiable even when information is combined.

Inclusion:
This questionnaire should be completed by HCWs who have self isolated with fever and/or persistent cough and have been off work since March 1st. Testing for Covid 19 is not currently routine so this is not a requirement.

Guidance:
Please read and complete as much of the attached survey as you are happy and able to. Please indicate below if you consent to your personal data being processed and managed as outlined in the privacy policy.

Survey point of contact:
Dr Angus de Wilton, Internal Medicine Trainee UCLH
Please email questions or queries to: angus.dewilton@nhs.net

If there are sections of the questionnaire you do not wish to complete please leave these blank.

You have the right to remove your data from this survey at any time. If you wish to withdraw your data, please email angus.dewilton@nhs.net and you will receive a reply within 30 days.

This questionnaire should take approximately no longer than 15 minutes. We appreciate your time.

I confirm I have read and understand the above information regarding the survey and have contact details of study investigation should I wish to ask further questions prior to participation *

☐ I consent

I have read any understood the privacy policy and consent to my data being processed, collected and utilised as described in this policy *

☐ I consent

I understand I am completing a voluntary survey and can withdraw at any time, without providing any reason and without my legal rights being affected *

☐ I consent

I consent to the information being distributed to third parties for the purpose of public health and research purposes in the futures, inside of the EEA *

☐ I consent

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

ABOUT YOU

What is your age

Please select...

What is your sex?

Please select...

Which trust do you currently work for?

Please select...

Is your main place of work?

Please select...

What is your role?

Please select...

Smoking Status

- ☐ Current Smoker > 20 a day
- ☐ Current Smoker <20 a day
- ☐ Ex smoker
- ☐ Non smoker
- ☐ Smoker of other substance (e.g.marijuana)

Are you in a 'Vulnerable Group' as per Public Health England guidelines?
These include age over 70, or age under 70 who would otherwise be advised to get a flu jab (see link for full list), or pregnant. Click here for the full list.

○ Yes ○ No ○ Unsure ○ I do not wish to disclose

Symptoms during Self Isolation; Health Care Worker (HCW) Survey Page 2 of 2

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Your Rights Under GDPR

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

EXPOSURES

Did you have contacted with patient(s) positive for Covid-19 during the 14 days prior to symptoms?

Please select...

Did you perform any aerosol generating procedures with Covid 19 positive patients in 14 days prior to symptom onset? Click here for more details.

Please select...

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Your Rights Under GDPR

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

SYMPTOMS

What day did your symptoms begin?

Please select...

Do/ Did you have a fever?

Please select...

Do you recall any non specific symptoms in the days prior to self isolation? If so, please explain. *(eg chills, malaise, fatigue, poor concentration, sleep disturbance)*

Did you have any symptoms lasting > 14 day

○ Yes ○ No

Which day did your symptoms peak? This is the day when symptoms most bothered you or disrupted your life.

Please select...

SPECIFIC SYMPTOMS

	Yes	No
Anosmia (loss of smell)	○	○
Anxiety	○	○
Chest Pain	○	○

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

	Yes	No
Coryzal Symptoms (runny nose, sneezing)	○	○
Cough	○	○
Diarrhea	○	○
Fever	○	○
Headache	○	○
Joint Pains/Myalgia	○	○
Rash	○	○
Sleep Disturbance	○	○
Shortness of Breath	○	○
Sore Throat	○	○
Vomiting	○	○

How would you describe your cough?

Please select...

Please comment on any other symptoms you experienced

Symptom Diary - if you are able to provide a more detailed description of your illness and how it progressed day to day, please provide that here.

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

MEDICAL ASSISTANCE

Were you tested for Covid-19 during your illness?

Please select...

Did you have access to any monitoring, which you used during your illness?

○ Yes ○ No

(examples: thermometer, blood pressure monitoring, pulse oximetry)

Did you take any medications during your illness:

☐ Antibiotics ☐ Codeine ☐ Herbal Remedies

☐ Ibuprofen/Naproxen ☐ Inhalers ☐ Paracetamol

☐ Phenylephrine ☐ Steroids ☐ Other

Please provide details of your answer above (eg duration of admission)

Did you seek/require medical assistance from any of the following:

Please select...

Please provide any other comments on health care seeking during your illness

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

RETURN TO WORK

What day did you return to work (if you required further absence please choose the first date of returning to work)?

Please select...

How many days were you off work in total?

Please select...

Did you feel ready to return to work when you did?

- ○ Yes
- ○ No

Did you require more time off work after your 7 day period of isolation?

- ○ Yes
- ○ No

Were you able to work at all from home during self isolation

Please select...

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Symptoms during Self Isolation; Health Care Worker (HCW) Survey

Symptoms during Self Isolation; Health Care Worker (HCW) Survey

HOME CONTACTS

How many people do you share a home with?

Please select...

If you were sharing a bed with a partner on day of symptom onset, did they become unwell during the following 14 days?

○ Yes ○ No ○ Prefer not to say

Were you able to isolate away from home contacts whilst symptoms?

○ Yes ○ No ○ Prefer not to say

(eg: own toilet, own room, etc.)

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Your Rights Under GDPR

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1
Objectives	3	State specific objectives, including any prespecified hypotheses	1
Methods			
Study design	4	Present key elements of study design early in the paper	2
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	2
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	2
Study size	10	Explain how the study size was arrived at	3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	2-3
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	N/A
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	2
		(b) Give reasons for non-participation at each stage	2
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	3
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	2-3
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	3-4
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	4
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	3-4
Generalisability	21	Discuss the generalisability (external validity) of the study results	4
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.