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Authors	O'Sullivan, Grainne;Jacob, S.;Barrett, Peter M.;Gallagher, J.
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Title: Covid-19 presentation among symptomatic healthcare-workers in Ireland: a case-control study

Authors: Dr. Grainne O'Sullivan, Dr. Sujil Jacob, Dr. Peter Barrett and Prof. John Gallagher

Author affiliations: Dr. Grainne O'Sullivan, Specialist Registrar in Occupational Medicine, Cork University Hospital, Cork, Ireland

Dr. Sujil Jacob, Specialist Registrar in Occupational Medicine, Cork University Hospital, Cork, Ireland

Prof. John Gallagher, Consultant in Occupational Medicine, Cork University Hospital, Cork, Ireland

Dr. Peter M. Barrett (1, 2)
1 – School of Public Health, University College Cork, Cork, Ireland
2 - Department of Public Health HSE-South, Cork, Ireland

Corresponding author:
Dr. Grainne O'Sullivan
Specialist Registrar in Occupational Medicine,
Cork University Hospital, Wilton, Cork, Ireland
021 4922018
Grainne_o_sullivan@yahoo.co.uk

Abstract:

Background: It is recognised that healthcare workers (HCWs) are at high risk of contracting Covid-19. It is incumbent on occupational health staff to recognise potential symptoms of Covid-19 among HCWs.

Aims: The aims of the study were to describe the presenting symptoms of HCWs who developed Covid-19 in Ireland, and to estimate the odds of specific symptoms being associated with a positive Covid-19 PCR result.

Methods: A retrospective chart review of all symptomatic HCWs who self-presented for Covid-19 testing in Cork from March to May 2020 was conducted. A sex-matched case-control study was carried out to compare presenting features among those who tested positive compared to those who tested negative. Univariate and multivariable-adjusted conditional logistic regression models were run using Stata 15.0 to identify the symptoms associated with positive Covid-19 swab results.

Results: 306 HCWs were included in the study; 102 cases and 204 controls. Common presenting features among cases were fever/chills (55%), cough (44%) and headache (35%). The symptoms which were significantly associated with a positive Covid-19 swab result were loss of taste/smell (aOR 12.15, 95% CI 1.36-108.79), myalgia (aOR 2.36, 95% 1.27-4.38), fatigue (aOR 2.31, 95% CI 1.12-4.74), headache (aOR 2.11 95% CI 1.19-3.74), and fever/chills (aOR 1.88, 95% CI 1.12-3.15).

Conclusions: Fever, fatigue, myalgia, loss of taste/smell and headache were associated with increased odds of a Covid-19 diagnosis among symptomatic self-referred HCWs compared with those had negative swab results. Testing criteria for HCWs should reflect the broad range of possible symptoms of Covid-19.

Key words: Covid-19, healthcare worker, SARS-CoV-2, symptoms, occupational health

Introduction:

Cardinal symptoms of Covid-19 are fever, new cough, and dyspnoea [1]. As the pandemic has evolved, the literature has highlighted a myriad of other presenting symptoms, including anosmia, hypogeusia, headache and diarrhoea [2,3,4,5,]. The wide spectrum of presenting symptoms makes it difficult to discern which suspect cases are more likely to test positive for SARS-CoV-2 infection.

In Ireland, one third of all confirmed cases of Covid-19 were among healthcare workers (HCWs) in the 'first wave' of the pandemic up to mid-July 2020 [6]. Early identification of infected HCWs is vital to minimise the risk of SARS-CoV-2 transmission to patients, other HCWs and the public. This is also necessary for maintaining workplace health and safety, and sustaining adequate levels of staffing.

. In this paper we present the descriptive epidemiology of symptomatic HCWs who selfpresentedfor Covid-19 testing , during the first 12 weeks of the pandemic. We undertook a case-control study to estimate the odds of a positive Covid-19 swab result during this time, based on HCWs' presenting symptoms.

Methods:

The Occupational Health Department (OHD) in Cork University Hospital (CUH), Ireland, had a dedicated testing centre for nasopharyngeal polymerase chain reaction (PCR) swab referrals. Any new or unexplained medical symptoms were considered an indication for testing, this didn't have to be a 'typical' symptom of Covid-19. Symptomatic HCWs self-presented by contacting the OHD directly; testing was arranged within 24 hours. The OHD provides support to HCWs who are employed in public healthcare facilities in Cork. Thus, HCWs who were employed in private facilities, or self-employed, were not included in the study.

Cases of SARS-CoV-2 infection were defined as symptomatic HCWs who had a positive Covid-19 swab result. Controls were defined as symptomatic HCWs whose swab didn't detect Covid-19. Cases and controls were selected from the same study period; 9th of March-31st of May 2020. Asymptomatic HCWs were excluded. We included two sex-matched controls for each case to reduce the possibility of confounding by sex, or by unmeasured sex-specific factors, and to enhance statistical power.

HCW role was categorised as medical, nursing, allied health professional (physiotherapy or pharmacy) or support staff (including healthcare assistants, multi-task attendants, cleaning, security, clerical and catering). The location of work was divided into three categories; Community hospitals (residential long-stay facilities), Model 2 hospitals (local/district hospitals which admit low acuity medical patients) and Model 4 hospital (large tertiary hospital) [7].

We collected information from paper records held in the OHD on the HCWs' presenting symptoms. The HCW was not examined by a doctor prior to testing. Data were recorded in Microsoft Excel in an irrevocably anonymised form. The data were transferred to Stata 15.0 and random matching by sex was undertaken.

We used multivariable-adjusted conditional logistic regression with backward selection to identify the demographic factors or presenting symptoms most strongly associated with positive Covid-19 swab results. We didn't include work location in the adjusted models since some community hospitals experienced large outbreaks of Covid-19 during the study period; this may have disproportionately impacted on the likelihood of HCWs testing positive.

Ethical approval for the study was granted by the Clinical Research Ethics Committee of the Cork University Teaching Hospitals.

Results:

There were 102 positive cases and 204 sex-matched controls. There was no significant difference in mean age at presentation between cases and controls. The majority of HCWs were either nurses 46.7%, (n=143) or support staff 35.3% (n=108) (Table 1).

The most common presenting symptoms among cases were fever/chills (55%), cough (44%), headache (35%) sore throat (31%) and myalgia (29%). Controls were most likely to present with cough (52%), sore throat (38%) or fever/chills (37%).

As shown in Table 2, no significant differences by age or work role were observed.

The symptoms which were significantly associated with a positive Covid-19 swab result were anosmia/hypogeusia (aOR 12.15, 95% CI 1.36-108.79), myalgia (aOR 2.36, 95% 1.27-4.38), fatigue (aOR 2.31, 95% CI 1.12-4.74) , headache (aOR 2.11 95% CI 1.19-3.74), and fever/chills (aOR 1.88, 95% CI 1.12-3.15). Other symptoms did not help to discriminate cases vs. controls.

Discussion:

The study outlines the frequency of specific symptoms among Covid-19 positive HCWs and it helps to highlight the wide spectrum of relevant symptoms which may warrant inclusion in Covid-19 testing criteria.

Five specific symptoms helped to discriminate Covid-19 positive HCWs from negative controls: fever, fatigue, myalgia, anosmia/hypogeusia and headache. Although onset of new cough is considered to be a cardinal feature of Covid-19 infection, it was a common symptom among HCWs who self-presented for testing in our study, including among those in whom Covid-19 was not detected. A small minority of HCWs in our study reported anosmia/hypogeusia. Nonetheless, these symptoms were strongly associated with a positive Covid-19 swab result and this is consistent with previous research [5]. Fever, myalgia and fatigue also helped to discriminate positive cases from controls. These symptoms are common presentations of influenza [8]. This demonstrates the difficulty in differentiating Covid-19 infection from influenza based on self-reported symptoms. This highlights the increased need for widespread influenza vaccination of HCWs during the Covid-19 pandemic [8].

Our study is largely representative of HCWs in public hospitals in Ireland in terms of gender, age and role [9].

Selection bias is a potential limitation since HCWs self-presented for testing. Negative controls may have had a higher representation of the 'worried well', and presenting symptoms were not objectively measured. A negative or "not detected" swab result only reflects a single point in time and we cannot

exclude the possibility of false negatives among our controls. Given that knowledge of Covid-19 symptoms evolved during the study period, we cannot exclude the possibility that the date of testing may have led to some unmeasured information bias.

Another limitation to consider is the reliability of the nasopharyngeal-PCR test. Studies have shown it to have a false negative rate between 2-29% [10].

In conclusion, fever, fatigue, myalgia, anosmia/hypogeusia and headache were associated with Covid-19 diagnosis among self-presenting HCWs in Ireland. This supports the need for these symptoms to be included in testing criteria for Covid-19.

Key points:

- There is limited evidence on the presenting symptoms of Covid-19 among HCWs. One third of all SARS-CoV-2 infections were in HCWs in Ireland in the first wave of the pandemic. It is not known if symptoms in HCWs differ from the general public.
- This case-control study examined features of symptomatic HCWs during the first wave of the pandemic in Ireland and compared those with positive PCR swabs to those with negative PCR swabs.
- Covid-19 can present with a broad constellation of symptoms. Fever, fatigue, myalgia, anosmia/hypogeusia and headache all helped to discriminate positive cases of Covid-19 among symptomatic HCWs. Inclusion of these symptoms in Covid-19 testing criteria may help to identify cases, thereby reducing the risk of further transmission to patients, staff and the wider community.

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Competing interests: None to declare

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Tables/Figures:

Table 1. Characteristics of healthcare workers who presented for Covid-19 testing in Cork, and their symptoms at presentation, March-May 2020

	Cases		Controls		χ^2: p
	n	**%**	**n**	**%**	
Gender					
- Female	79	77.4	158	77.4	
- Male	23	22.6	46	22.6	
Age					
Mean (s.d.)		*44.1±11.2*		*41.9±11.1*	*0.10*
- 20-39	35	34.3	78	38.2	0.76
- 40-49	36	35.3	75	36.8	
- 50-59	24	23.5	38	18.6	
- 60+	7	6.9	13	6.4	
Role					
- Doctor	10	9.8	21	10.3	0.68
- Nurse	52	51.0	91	44.6	
- Allied Health professional*	6	5.9	18	8.8	
- Support staff**	34	33.3	74	36.3	
Location					
- Community hospital	36	35.3	32	15.7	<0.001
- Model 2 hospital	37	36.3	63	30.9	
- Model 4 hospital	29	28.4	109	53.4	
Symptoms					

- Pyrexia/chills	56	54.9	76	37.3	<0.01
- Cough	45	44.1	55	51.5	0.23
- Dyspnoea	9	8.8	27	13.2	0.26
- Chest tightness	14	13.7	17	8.3	0.14
- Fatigue	23	22.6	17	8.3	<0.01
- Myalgia	30	29.4	27	13.2	<0.01
- Headache	36	35.3	40	19.6	<0.01
- Sore throat	32	31.4	79	38.4	0.21
- Rhinitis	11	10.8	24	11.8	0.80
- Nasal congestion	9	8.8	11	5.4	0.25
- Anosmia	4	3.9	1	0.5	0.04
- Hypogeusia	4	3.9	0	0.0	0.01
- Diarrhoea	1	1.0	2	1.0	1.00

Table 2. Multivariable adjusted logistic regression for positive Covid-19 PCR swab result among healthcare workers by characteristics and presenting symptoms

	Unadjusted		**Adjusted**		**p**
	OR	**95% CI**	**aOR**	**95% CI**	
Age					
- 20-39	Ref.	Ref.			
- 40-49	1.07	0.61-1.88			
- 50-59	1.41	0.74-2.69			
- 60+	1.20	0.44-3.27			
Role					
- Nurse	Ref.	Ref.			
- Doctor	0.83	0.33-1.90			
- Allied Health professional*	0.58	0.22-1.56			
- Support staff**	0.80	0.47-1.37			
Symptoms					
- Fever/chills	2.05	1.27-3.32	1.88	1.12-3.15	0.016
- Cough	0.74	0.46-1.20			
- Dyspnoea	0.63	0.29-1.40			
- Chest pain/tightness	1.75	0.83-3.71			
- Fatigue	3.20	1.62-6.32	2.31	1.12-4.74	0.023
- Myalgia	2.73	1.52-4.92	2.36	1.27-4.38	0.007
- Headache	2.24	1.31-3.81	2.11	1.19-3.74	0.01
- Postnasal symptoms	0.87	0.54-1.40			
- Loss of taste/smell	10.46	1.21-90.79	12.15	1.36-108.79	0.026