

## **SUPPLEMENTARY MATERIALS**

## Appendix A: Study methods

Patient-level secondary care records were extracted from the Hospital Episode Statistics (HES) database for all patients diagnosed with either aspergillosis or candidiasis over the period March 2018 to October 2021; the diagnosis could be either a primary diagnosis or secondary diagnosis.

In addition, during the COVID-19 period (March 2020–October 2021) patients with a previous diagnosis of COVID-19 were identified by analysing all previous secondary care records for patients admitted to hospital with a diagnosis of aspergillosis or candidiasis (a patient is deemed to have had a diagnosis of COVID-19 if it occurs within the same spell as their aspergillosis or candidiasis diagnosis or in a previous spell).

These records were subsequently aggregated in order to produce an analysis around the impact of COVID-19 on serious and invasive fungal infections in England. Patient data from the pre-COVID-19 period has been compared to patient data in the COVID-19 period; and within the COVID-19 period itself, the data of patients with a previous diagnosis of COVID-19 has been compared to those with no previous diagnosis of COVID-19.

For the purposes of the study, the pre-COVID-19 period has been defined as March 2018–February 2020 and the COVID-19 period as March 2020–October 2021.

In order to identify patients with a relevant diagnosis of aspergillosis or candidiasis, the following ICD-10 codes from the International Statistical Classification of Diseases and Related Health Problems, 10th Revision were used:

Diagnosis group	ICD-10 code	Diagnosis description
<b>Aspergillosis</b>	B44.0	Invasive pulmonary aspergillosis
	B44.1	Other pulmonary aspergillosis
	B44.7	Disseminated aspergillosis
	B44.8	Other forms of aspergillosis
	B44.9	Aspergillosis, unspecified
<b>Candidiasis</b>	B37.1	Pulmonary candidiasis
	B37.5	Candidal meningitis
	B37.6	Candidal endocarditis
	B37.7	Candidal sepsis

In order to identify patients with a relevant diagnosis of COVID-19, the following ICD-10 codes from the International Statistical Classification of Diseases and Related Health Problems, 10th Revision were used:

ICD-10 code	Diagnosis description
U07.1	COVID-19, virus identified
U07.2	COVID-19, virus not identified

### Data access

Secondary care data is taken from the English Hospital Episode Statistics (HES) database produced by NHS Digital, the new trading name for the Health and Social Care Information Centre (HSCIC) Copyright © 2023, the Health and Social Care Information Centre. Re-used with the permission of the Health and Social Care Information Centre. All rights reserved.

## Appendix B: HES disclaimer

1. Secondary care data is taken from the English Hospital Episode Statistics (HES) database produced by NHS Digital, the new trading name for the Health and Social Care Information Centre (HSCIC) Copyright © 2023, the Health and Social Care Information Centre. Re-used with the permission of the Health and Social Care Information Centre. All rights reserved.
2. HES Data must be used within the licencing restrictions set by NHS Digital, which are summarised below. Wilmington Healthcare accept no responsibility for the inappropriate use of HES data by your organisation.
  - 2.1. One of the basic principles for the release and use of HES data is to protect the privacy and confidentiality of individuals. All users of HES data must consider the risk of identifying individuals in their analyses prior to publication/release.
    - 2.1.1. Data should always be released at a high enough level of aggregation to prevent others being able to 'recognise' a particular individual. To protect the privacy and confidentiality of individuals, Wilmington Healthcare have applied suppression to the HES data - '\*' or '-1' represents a figure between 1 and 7. All other potentially identifiable figures (e.g. patient numbers, spell counts) have been rounded to the nearest 5.
    - 2.1.2. On no account should an attempt be made to decipher the process of creating anonymised data items.
  - 2.2. You should be on the alert for any rare and unintentional breach of confidence, such as responding to a query relating to a news item that may add more information to that already in the public domain. If you recognise an individual while carrying out any analysis you must exercise professionalism and respect their confidentiality.
  - 2.3. If you believe this identification could easily be made by others you should alert a member of the Wilmington Healthcare team using the contact details below. While

- appropriate handling of an accidental recognition is acceptable, the consequences of deliberately breaching confidentiality could be severe.
- 2.4. HES data must only be used exclusively for the provision of outputs to assist health and social care organisations.
  - 2.5. HES data must not be used principally for commercial activities. The same aggregated HES data outputs must be made available, if requested, to all health and social care organisations, irrespective of their value to the company.
  - 2.6. HES data must not be used for, including (but not limited to), the following activities:
    - 2.6.1. Relating HES data outputs to the use of commercially available products. An example being the prescribing of pharmaceutical products
    - 2.6.2. Any analysis of the impact of commercially available products. An example being pharmaceutical products
    - 2.6.3. Targeting and marketing activity
  - 2.7. HES data must be accessed, processed and used within England or Wales only. HES data outputs must not be shared outside of England or Wales without the prior written consent of Wilmington Healthcare.
  - 2.8. If HES data are subject to a request under the Freedom of Information Act, then Wilmington Healthcare and NHS Digital must be consulted and must approve any response before a response is provided.
3. 2022/23 HES data are provisional and may be incomplete or contain errors for which no adjustments have yet been made. Counts produced from provisional data are likely to be lower than those generated for the same period in the final dataset. This shortfall will be most pronounced in the final month of the latest period, e.g. September from the April to September extract. It is also probable that clinical data are not complete, which may in particular affect the last two months of any given period. There may also be errors due to coding inconsistencies that have not yet been investigated and corrected.
  4. ICD-10 codes, terms and text © World Health Organization, 1992-2023

5. The OPCS Classification of Interventions and Procedures, codes, terms and text is Crown copyright (2023) published by NHS Digital, the new trading name for the Health and Social Care Information Centre, and licensed under the Open Government Licence.
6. Contains public sector information licensed under the Open Government Licence v3.0. A copy of the Open Government Licence is available at:  
[www.nationalarchives.gov.uk/doc/open-government-licence/open-government-licence.htm](http://www.nationalarchives.gov.uk/doc/open-government-licence/open-government-licence.htm)
7. No part of this database, report or output shall be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of Wilmington Healthcare Ltd. Information in this database is subject to change without notice. Access to this database is licensed subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated in any form without prior consent of Wilmington Healthcare Ltd.
8. Whilst every effort has been made to ensure the accuracy of this database, Wilmington Healthcare Ltd makes no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability or suitability of the data. Any reliance you place on the data is therefore strictly at your own risk. Other company names, products, marks and logos mentioned in this document may be the trademark of their respective owners.
9. You can contact Wilmington Healthcare by telephoning 0845 121 3686, by e-mailing [client.services@wilmingtonhealthcare.com](mailto:client.services@wilmingtonhealthcare.com) or by visiting [www.wilmingtonhealthcare.com](http://www.wilmingtonhealthcare.com)

**Supplementary Table A. *Candida*-related codes excluded from the analysis**

ICD-10 code	Diagnosis description
B37.0	Candidal stomatitis <ul style="list-style-type: none"><li>• Oral thrush</li></ul>
B37.2	Candidiasis of skin and nail <ul style="list-style-type: none"><li>• Candidal onychia</li><li>• Candidal paronychia</li></ul>
B37.3	Candidiasis of vulva and vagina <ul style="list-style-type: none"><li>• Candidal vulvovaginitis</li><li>• Monilial vulvovaginitis</li><li>• Vaginal thrush</li></ul>
B37.4	Candidiasis of other urogenital sites <ul style="list-style-type: none"><li>• Candidal balanitis</li><li>• Candidal urethritis</li></ul>
B37.8	Candidiasis of other sites <ul style="list-style-type: none"><li>• Candidal cheilitis</li><li>• Candidal enteritis</li></ul>
B37.9	Candidiasis, unspecified <ul style="list-style-type: none"><li>• Thrush not otherwise specified</li></ul>

**Supplementary Table B.** Outcomes in patients with aspergillosis and candidiasis before COVID-19 (2 years between March 2018–February 2020) and during the COVID-19 period (18 months between March 2020 to October 2021).

Outcome	Aspergillosis	Candidiasis
Patients with SIFI before COVID-19	6,255	3,445
Patients with SIFI during COVID-19 period	4,880	2,990
All admitted patients with no previous COVID-19 diagnosis, n	4,350	2,385
Of all admitted patients with no previous COVID-19 diagnosis, those admitted to CCU, n (%)	575 (13.2)	885 (37.1)
All admitted patients who had had a diagnosis of COVID-19, n	600	600
Of all admitted patients who had a diagnosis of COVID-19, those admitted to CCU, n (%)*	315 (52.5)	360 (60.0)
Mean length of stay for SIFI before COVID-19, days	7.7	23.3
Mean length of stay for SIFI during COVID-19 period, days	10.2	28.6
All spells for SIFI for patients who had had a diagnosis of COVID-19, days	20.2	27.2
All spells for SIFI for patients with no previous COVID-19 diagnosis, days	9.0	28.8
All COVID-19 spells, days	11.9	11.9
Mean length of stay in CCU during COVID-19 period		
Patients with SIFI in CCU who had had a diagnosis of COVID-19, days	26.0	22.4
Patients with SIFI in CCU with no previous COVID-19 diagnosis, days	18.1	22.0
All COVID-19 spells in CCU, days	10.8	10.8
30-day readmission during COVID-19 period		
Patients who had had a diagnosis of COVID-19, %	12.6	3.7
Patients with no previous diagnosis of COVID-19, %	8.6	2.5
Failed discharge during COVID-19 period		

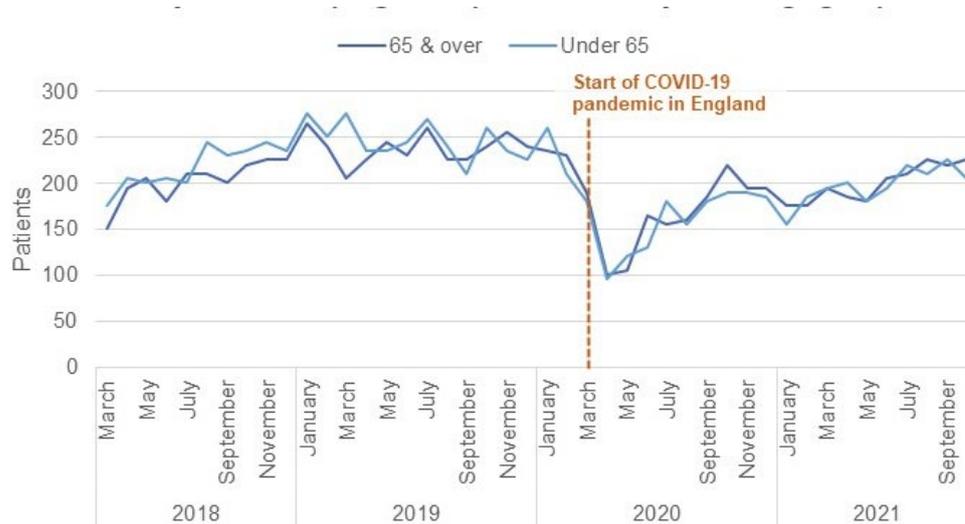
Patients who had had a diagnosis of COVID-19, %	6.6	3.0
Patients with no previous diagnosis of COVID-19, %	4.2	1.7

CCU, critical care unit.

\*If a patient had COVID and SIFI within the same spell, they are part of the 'had had a diagnosis of COVID' group.

**Supplementary Figure A.** Monthly trend in serious invasive fungal infection (SIFI) patient count by broad age group, March 2018 to October 2021: aspergillosis (a) and candidiasis (b).

(a)



(b)

