BMJ Open Respiratory Research

# Differences in severe exacerbations rates and healthcare utilisation in COPD populations in the UK and France

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**To cite:** Whittaker H, Van Ganse E, Dalon F, *et al*. Differences in severe exacerbations rates and healthcare utilisation in COPD populations in the UK and France. *BMJ Open Resp Res* 2022;**9**:e001150. doi:10.1136/bmjresp-2021-001150

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjresp-2021-001150).

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Received 15 November 2021
Accepted 31 July 2022



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## ABSTRACT

**Introduction** Chronic obstructive pulmonary disease (COPD) is a leading cause of mortality in Europe; however, it is important to understand how clinical practice patterns differ between countries and how this might relate to disease outcomes, to identify ways of improving local disease management. We aimed to describe and compare the management of patients with COPD in the UK and France between 2008 and 2017.

**Methods** We used data from the Clinical Practice Research Datalink GOLD and Hospital Episode Statistics in the UK and the Echantillon Généraliste des Bénéficiaire in France to identify patients with COPD each year between 2008 and 2017. We compared patient characteristics, all-cause mortality and COPD exacerbations each year between 2008 and 2017 for patients in the UK and France separately. Health care utilisation and COPD exacerbations in 2017 were compared between France and the UK using t-tests and $\chi^2$ tests.

**Results** Patients with COPD were similar in gender and comorbidities in both countries. Incidence of COPD exacerbations remained stable in the UK and France between 2007 and 2017. In 2017, the proportion of all-cause and COPD-related hospitalisations was greater in the UK than in France (43.9% vs 32.8% and 8.3% vs 4.9%, respectively; p<0.001) as was the proportion of patients visiting accident and emergency (A&E) (39.8% vs 16.2%, respectively; p<0.001). In addition, the mean length of stay in hospital for COPD-related causes was shorter in the UK than in France (6.2 days (SD 8.4) vs 10.5 days (SD 9.1), respectively; p<0.001).

**Discussion** Overall, UK patients were more likely to go to A&E, be hospitalised for COPD-related causes and stay in hospital for fewer days after being admitted for COPD-related reasons compared with patients in France, illustrating a difference in health-seeking behaviours and access to healthcare.

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Chronic obstructive pulmonary disease (COPD) is a leading cause of mortality in Europe, but little is known about how clinical practice patterns differ between counties and how this might be related to disease outcomes.

### WHAT THIS STUDY ADDS

⇒ Our study found significant differences in COPD management between France and the UK.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study highlights the importance of understanding healthcare systems in relation to study outcomes and how findings may differ due to differences in health-seeking access or behaviour, rather than the outcome itself.

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of mortality and disability-adjusted life years globally and in Europe. However, differences in COPD-related mortality and hospitalisations exist between countries.[1] The UK has one of the highest COPD mortality rates in Europe (236.0 deaths/100 000 in adults over 65 years) while France has one of the lowest (54.8/100 000).[2] This may be due to various reasons, such as differences in quality of COPD diagnosis or management.[3 4] Evaluating disease management strategies across countries will help understand practice patterns and how they might relate to disease outcomes.

Few studies using routinely collected deidentified healthcare records have compared clinical outcomes across countries. One cross-national comparison of asthma management in France and the UK found differences in therapy use.[5] Given the high prevalence of COPD and differences in COPD-related mortality in France and the UK, we aimed to describe and compare healthcare utilisation (HCU) and management of patients with

COPD in the UK and France each calendar year between 2008 and 2017.

## METHODS

### Data sources

We conducted repetitive cross-sectional studies using the Clinical Practice Research Datalink (CPRD) GOLD linked to Hospital Episode Statistics in the UK, and the EGB (Echantillon Généraliste des Bénéficiaires) in France. We chose this study design to observe temporal trends at the population level in each country, rather than trends at the individual level.

CPRD GOLD is a primary care electronic healthcare record database that regularly collects data from general practices who agree to contribute and adds data to its ever-growing database. General practitioners (GPs) record patient information during a consultation through a software system that is used to create CPRD databases. General practices have the option to opt into the contribution of data to CPRD whereas individual patients have the option to opt out. Data in CPRD GOLD are collected through a GP recording software system called Vision. As of February 2020, a total of 371 practices across the UK were currently contributing to CPRD GOLD, equivalent to 4.1% of all practices in the UK.[6] It is important to note that since 2014, many GPs have switched from using Vision software (that forms CPRD GOLD) to Emis software (that forms CPRD's second database CPRD Aurum). For this reason, absolute numbers of people included in CPRD GOLD has decreased substantially over the years. When compared with the 2011 census, patients included in CPRD GOLD were representative of the general UK population in terms of age, gender and ethnicity.[7 8]

EGB is a 1/97e random sample of the French health insurance reimbursement database, and is representative for the French population.[9] The EGB records individual anonymous information from primary and secondary care. It contains: (a) characteristics (gender, month and year of birth, month and year of death if applicable); (b) all non-hospital reimbursed healthcare expenditures with date and code (visits and medical procedures, laboratory tests, drugs and medical devices, but not the corresponding medical indication or results); (c) hospital discharge summaries (International Classification of Diseases 10th Revision diagnoses codes for all medical, obstetric and surgery hospitalisations with the date and duration of hospitalisation, medical procedures, hospital department and cost coding system). Due to differences in databases, including global size, a significant difference in number of participants were included from each database.

### Inclusion of patients with COPD

In each database patients with COPD were defined for each year (from 2008 to 2017) using the following two inclusion criteria: (1) patients hospitalised with COPD (online supplemental file p.7) or (2) patients who received long-acting bronchodilators (long-acting beta agonist (LABA), long-acting muscarinic antagonist (LAMA), long-acting beta agonist/inhaled corticosteroid (LABA/ICS), and LABA/LAMA fixed dose combinations) over three consecutive quarters. In addition to this, patients were required to be older than 40 years old. Patients admitted to hospital for asthma 2 years prior to inclusion for that specific year and over the studied year were excluded. These definitions were based on previous literature.[10–13] In the UK, patients with COPD were required to be current/ex-smokers and have a COPD diagnosis code (not available in France) based on previous validation of the identification of patients with COPD in CPRD GOLD.[14] Patients in the UK were also required to be eligible for secondary care linkage on the years where they were selected for the cross-sectional study and to have a 'last data collection date' (if patients transferred out of the general practice or died) on or after the year of study.

### Outcomes of interest

Age, gender, comorbidities (diabetes, anxiety, depression, cardiovascular disease (CVD), bronchiectasis and lung cancer), acute exacerbations of COPD (AECOPD) requiring hospitalisation and mortality were described each year in both countries using descriptive statistics. Hospitalisations (all-cause, COPD-related and cardiovascular-related) and HCU (primary care, outpatient and accident and emergency (A&E) visits) were described for the years 2008 and 2017. Exacerbations and HCU in 2017 were compared between the UK and France using $\chi^2$ tests and t-tests.

## RESULTS

Between 13 939 and 40 938 patients with COPD were identified each year between 2008 and 2017 in the UK, and between 5 288 and 8 528 in France. Mean age each year varied from 70.9 (SD 10.8) to 71.5 (SD 10.8) in the UK and 65.8 (SD 13.1) to 66.8 (SD 12.9) in France. A similar proportion of men and women had COPD each year in both countries (online supplemental tables E1–E3). All-cause mortality remained consistent from 2008 to 2017 but was higher in the UK (3.5% of patients in 2017 in the UK, 2.0% in France; see online supplemental table E3). The most common comorbidities in both countries were anxiety and depression, followed by diabetes and CVD (figure 1).

### Exacerbations

Incidence of severe AECOPD requiring hospitalisation remained relatively stable in both France and the UK but it was consistently higher in the UK than France (in 2017, 1 666 of 13 939 (12.0%) patients in the UK and 457 of 8 528 (5.4%) in France) (online supplemental figure E1). While mean numbers of hospitalised exacerbations per patient between countries in 2017 was statistically

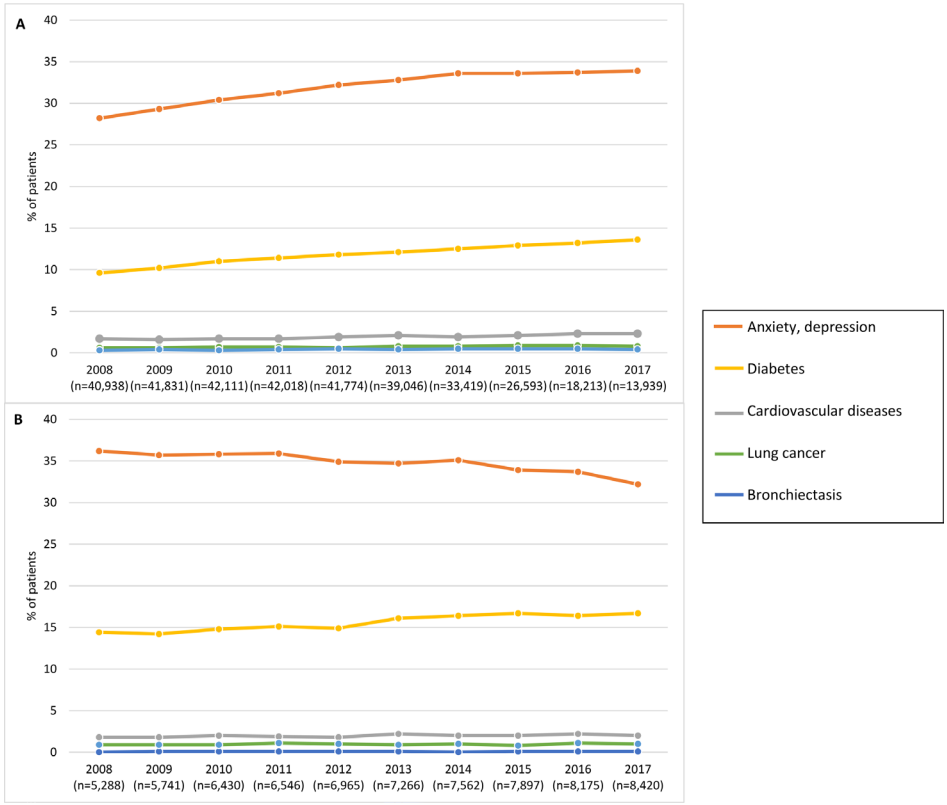


**Figure 1** Comorbidities in chronic obstructive pulmonary disease patients in (A) the UK and (B) France.

different (p<0.0001), the overall difference was small (table 1).

## Hospitalisations

The percentages of all-cause hospitalisations increased between 2008 and 2017 in both countries, however, the increase was slightly greater in the UK (online supplemental figure E2). In 2017, the percentage of all-cause and COPD-related hospitalisations was greater in the UK than in France (table 2). A total of 6 121 of 13 393 (43.9%) patients with COPD in 2017 in the UK were hospitalised for all-causes compared with 2 793 of 8528 (32.8%) in France (p<0.0001). COPD specific hospitalisations occurred in 1 157 of 13 939 (8.3%) patients with COPD in the UK in 2017 but only in 420 of 8 528 (4.9%) in France (p<0.0001). CVD specific hospitalisation occured in 149 of 13 939 (1.1%) patients with COPD in the UK in 2017 and in 36 of 8 528 (0.4%) in France (p<0.0001).

Mean length of all-cause hospital stays was similar in 2017 between the UK and France (4.3 days (SD 8.1) in the UK vs 4.8 days (SD 7.4) in France; p<0.0001) but COPD-related hospital stays were shorter in the UK compared with France (6.2 days (SD 8.4) in the UK vs 10.5 days (SD 9.1) in France; p<0.0001) and CVD-related hospital stays were longer (9.3 days (SD 11.3) in the UK vs 5.3 days (SD 4.0) in France) (table 2 and online supplemental table E4). Interestingly, the mean number of all-cause, COPD and CVD-related hospitalisations was similar between countries, although statistically significant.

**Table 1** Difference in exacerbations requiring hospitalisation in 2017 in the UK and France

| | UK | France | P value |
|---|---|---|---|
| Number of patients experiencing a severe AECOPD (%)* | 1666 (12.0) | 457 (5.4) | <0.0001 |
| Mean number of severe AECOPD events per patient† (SD) | 1.3 (0.7) | 1.2 (0.5) | <0.0001 |

*The denominator is the number of patients included for year 2017, that is, patients matching all inclusion criteria (UK n=13 939 and France n=8528).
†In patients with at least one exacerbation.
AECOPD, acute exacerbations of chronic obstructive pulmonary disease.

## Healthcare visits

From 2008 to 2017 in the UK, the proportion of patients seen in respiratory outpatient clinics and visiting A&E increased from 9.8% to 13.9% and from 26.9% to 39.8%, respectively. In France, the proportion of patients seen in respiratory outpatient clinics decreased minorly from 8.8% in 2008 to 7.3% in 2017 but A&E visits increased from 11.1% to 16.2%. While the number of patients visiting A&E increased in both countries, the increase from 2008 to 2017 was larger in the UK. Overall, the

Table 2 Healthcare utilisation in 2017 in patients with COPD identified in the UK and France

| Type of healthcare utilisation | | UK | France | P value |
|---|---|---|---|---|
| All-cause hospitalisations | Number of patients (%) | 6121 (43.9) | 2793 (32.8) | <0.0001 |
| | Mean numbers of stays* (SD) | 2.7 (6.2) | 2.7 (5.9) | 1.00 |
| | Mean number of days in hospital* (SD) | 4.3 (8.1) | 4.8 (7.4) | <0.0001 |
| COPD-related hospitalisations | Number of patients (%) | 1157 (8.3) | 420 (4.9) | <0.0001 |
| | Mean numbers of hospital stays* (SD) | 1.5 (1.2) | 1.4 (1.0) | <0.0001 |
| | Mean number of days in hospital* (SD) | 6.2 (8.4) | 10.5 (9.1) | <0.0001 |
| CVD-related hospitalisations | Number of patients (%) | 149 (1.1) | 36 (0.4) | <0.0001 |
| | Mean numbers of hospital stays* (SD) | 1.2 (0.5) | 1.3 (0.6) | <0.0001 |
| | Mean number of days in hospital* (SD) | 9.3 (11.3) | 5.3 (4.0) | <0.0001 |
| GP visits | Number of patients (%) | 13366 (95.9) | 8226 (96.5) | 0.032 |
| | Mean number of visits* (SD) | 14.8 (11.7) | 8.2 (6.1) | <0.0001 |
| Respiratory-related OP appointments | Number of patients (%) | 1400 (13.9) | 619 (7.3) | <0.0001 |
| | Mean number of visits* (SD) | 3.1 (3.5) | 1.8 (2.7) | <0.0001 |
| A&E visits | Number of patients (%) | 5546 (39.8) | 1378 (16.2) | <0.0001 |
| | Mean number of visits* (SD) | 2.3 (2.5) | 1.4 (0.9) | <0.0001 |

The denominator is the number of patients included for year 2017, that is, patients matching all inclusion criteria (UK n=13939 and France n=8528).
*In patients with at least one visit.
A&E, accident and emergency; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; GP, general practitioner; OP, outpatient.

proportion of patients visiting primary care in both countries remained similar in 2008 and 2017 (online supplemental figure E2).

In 2017, the proportion of patients visiting primary care was similar in France and the UK (8 226 of 8 528 (96.5) and 13366 of 13939 (95.9%), respectively). However, the proportion of patients seen in COPD-related outpatient clinics and visiting A&E was higher in the UK than in France; 1 400 of 13939 (13.9%) patients in the UK compared with 619 of 8 528 (7.3%) in France were seen in COPD-related outpatient clinics and 5 546 of 13939 (39.8%) of patients in the UK compared with 1 378 of 8 528 (16.2%) in France visiting A&E (table 2). Mean numbers of primary care visits, outpatient appointments and A&E visits per patient were also higher in the UK than in France (table 2 and online supplemental table E4).

## DISCUSSION

Our study was the first to compare patients with COPD in the UK and France with regards to hospitalised exacerbations of COPD and HCU. Overall, we found that significant differences in COPD management exist between France and the UK. Firstly, while patients with COPD in the UK and France had similar characteristics, UK patients with COPD were more likely to be hospitalised for any cause as well as COPD-specific causes, including for exacerbations of COPD, than patients in France. Secondly, the mean length of time in hospital for a COPD event was shorter in patients with COPD in the UK than in France. Thirdly, patients in the UK were more likely to visit A&E and visit respiratory-related outpatient clinics than French patients and a similar proportion of patients in both countries visited primary care.

One main reason for the differences in outcome events is likely be due to differences in health seeking behaviours in the UK and in France. The longer length of hospital stays in France might be due to long waiting lists for respiratory rehabilitation centres. Therefore, patients who are hospitalised might be kept in hospital for longer before being discharged for rehabilitation. This phenomenon, however, is not seen in the UK and could explain the differences seen in lengths of hospital stays. On the other hand, it could also suggest that patients hospitalised for COPD in the UK are less severe than those in France. Alternatively, patients in the UK might be more likely to seek help from secondary care services prior to visiting their GP, and therefore have less severe disease than patients admitted to hospitals in France. This is in line with previous studies showing that the number of people attending primary care fell by 27.5% between 2012 and 2017 in the UK.[15] The UK also has one of the lowest numbers of GPs per 100000 inhabitants in Europe. In 2014, there were on average 80.1 GPs per 100000 inhabitants whereas in France this figure was 159.8/100 000 inhabitants.[16] While we did not observe a decline in the proportion of patients with COPD attending primary care in our study, we did see an increase in the number of people admitted to A&E which increased from 26.9% to 39.8% from 2008 to 2017 in the

UK. This is in line with the literature which shows that the number of A&E admissions in the general population in the UK rose by 28% from 2011 to 2019.[17] A small increase in the number of people admitted to A&E was seen in France which is in line with previous literature that showed that in people with asthma, the proportion of patients who visited a hospital practitioner increased from 31.6% in 2009 to 37.8% in 2016.[18] Overall, the higher proportion of patients hospitalised in our study is consistent with previous literature that showed that COPD hospitalisation rate in the UK was 155.6/100 000 compared with 93.7/100 000 in France.[19] Our findings also suggest that future definitions of hospitalisations may need to be expanded to include other aspects of disease severity than healthcare usage.

We also found that all-cause mortality was higher in the UK COPD population than in France. The UK has one of the highest COPD mortality rates in Europe, possibly due to differences in tobacco legacy, air pollution and diet.[20] The higher proportion of patients dying from any cause in the UK is consistent with previous literature that showed that age-standardised all-cause mortality rate in the UK was 25.9/100 000 compared with 6.9/100 000 in France in people with COPD.[19] We could not identify substantial differences in patients' characteristics thus, the difference observed in mortality may be partly due to a higher all-cause mortality rate in the UK compared with France (790 vs 750/100 000 in 2015).[21]

One limitation is that prescriptions or dispensing and/or hospitalisations were used to define variables to align definitions between the two different databases. Diagnoses made in primary care in the UK were not used and could have biased results. For example, CVD was based on hospitalisations, not primary care diagnoses, and results should be interpreted accordingly. In addition, it is important to highlight the decreasing number of patients in CPRD GOLD. This is due to practices switching from Vision software, which contributes to CPRD GOLD, to using EMIS software, which contributes to CPRD Aurum. For this study, we only used CPRD GOLD however the proportion of patients meeting the inclusion criteria each year remained consistent (from 1.1% to 1.6%), which was also seen in the French data. It should also be noted that CPRD GOLD is a larger database than the EGB which is why a larger population of patients with COPD were included each year compared with the population in France. While absolute numbers of patients with COPD differed between databases, a similar proportion of patients with COPD were identified each year in France and the UK. In the UK, patients were additionally required to have a clinical diagnosis of COPD and have current or ex-smoking status. This is based on a validated algorithm of determining patients with COPD in CPRD GOLD and due to data availability limitations.[14] While this algorithm would improve the certainty of including patients with COPD, rather than patients with asthma, for example, it does limit the comparability of findings with patients identified in the EGB data. Despite this, our previous work shows that only 7.3% of patients with a clinical diagnosis of COPD were never smokers in a CPRD GOLD COPD cohort in the UK and we believe that patients hospitalised for COPD or on long-term COPD therapy would have also been given a COPD diagnosis in primary care in France.[22]

## CONCLUSION

Our study not only highlights the importance of understanding healthcare systems in relation to study outcomes but helps to contextualise data from cross-country observational studies; it should be considered that findings may differ due to differences in health-seeking access or behaviour, rather than the outcome itself. This is especially important in studies where outcomes are identified based on healthcare use, such as COPD exacerbations.

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**Contributors** EVG and JKQ planned the study and are the guarantors of the study. HW, FD, MN, MB conducted the study. HW, EVG, FD, MN, CM-M, JKQ, MB wrote the manuscript. CP, DPR, GD provided study feedback.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** HW reports grants from GSK, AZ and BI, outside the submitted work. JKQ reports grants and personal fees from British Lung Foundation, AZ, Asthma UK, BI, Bayer, GSK, MRC and Chiesi, outside the submitted work. MN, CM-M, MB and FD are employees of PELyon. EVG is the scientific advisor of PELyon. CP received support from AZ, BI, GSK, Chiesi and Novartis to attend medical meetings and fees for conferences.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data may be obtained from a third party and are not publicly available. Data are available on request from the Clinical Practice Research Datalink (CPRD). Their provision requires the purchase of a license and our license does not permit us to make them publicly available to all. We used data from the version collected in February 2020. To allow identical data to be obtained by others, via the purchase of a license, we will provide the code lists on request. Licenses are available from the CPRD (http://www.cprd.com): The Clinical Practice Research Datalink Group, The Medicines and Healthcare products Regulatory Agency, 10 South Colonnade, Canary Wharf, London E14 4PU.This research was supported by the NIHR Imperial Biomedical Research Centre (BRC) and PELyon. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care. Regarding EGB data, due to NHS and SNDS rules, no data sharing is possible as access to data is restricted to habilitated and qualified researchers (MN is habilitated and qualified).

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