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REVIEW

Clinical Audits in Chronic Obstructive Pulmonary Disease: what for?

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ABSTRACT

The complexity of healthcare and the rapid and constant changes in technology and therapies for chronic obstructive pulmonary disease (COPD) may generate uncertainty in decision-making and variability in clinical practice. Currently, there is a gap between the medical care that patients receive and the recommended practice. In both primary and secondary care, there are unjustified variations in practice and outcomes, which cannot be explained by the characteristics of the patients. Clinical audits emerge as an overarching tool that allows a constantly updating process that feeds back with the aim of improving healthcare. The objective of this review is to update the clinical audits for COPD as an available tool with a potential to improve healthcare. Clinicians and health managers should work hand in hand to overcome current limitations and be able to give the best possible clinical care for patients with COPD. **(BRN Rev. 2019;5(2):120-134)**

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INTRODUCTION

The evaluation of the clinical activity aimed at healthcare improvement should be part of the daily clinical work. However, the training received by attending physicians in quality of care of care remains scant. This statement is particularly relevant when it comes to chronic, serious diseases with a profound impact on patients' lives, their families or the health system. In this sense, chronic obstructive pulmonary disease (COPD) is a first-magnitude disease in terms of morbidity and mortality[1], with a wide prevalence in the population[2] and a significant impact on the health system[3,4]. Therefore, the healthcare of the patient with COPD should take advantage of the highest quality standards[5] aiming for improvement of the clinical outcomes.

FACTORS ASSOCIATED WITH CLINICAL OUTCOMES

To understand the importance of the evaluation of the quality of care in COPD, it is necessary to review which are the main variables that are associated with clinical outcomes. As physicians, we can easily come up with various relevant clinical variables that can be divided from an academic perspective into three main domains. Firstly, some variables are related to the characteristics of the patients and their style of living. Important aspects such as age, sex, genome, toxic habits or even their personality are vital factors that will condition health outcomes. Regarding COPD, there is a considerable number of studies reporting the importance of these factors: the prevalence of the disease has been associated with age and sex[6]; sex differences in symptoms perception and prognosis have also been discussed[7]; diet has also been pointed out as related to COPD[8-10]; and, genome and the presence of certain polymorphisms have been associated with different clinical outcomes[11,12].

Secondly, disease-related variables and their impact on health outcomes are also relevant. Among these factors we can mention the severity of a particular case, its progression over time or the onset of complications. In COPD, there is considerable information indicating the importance of disease-related variables with clinical outcomes alone or in combination[14-16]. Furthermore, lung function trajectories from the early years have also been reported to be of interest[13].

Finally, a third group of variables are probably social and environmental aspects. Factors such as social or family support and the potential impact of the disease on social behaviour or environmental exposures would be equally important in relation to health outcomes. For instance, occupational exposures are relevant in the progression of the disease in COPD[17] and indoor and outdoor pollution have been related to different COPD-associated outcomes[18-19].

Altogether, these three aspects, i.e. patient characteristics and lifestyle, disease features and social and environmental determinants, are clearly associated with the clinical outcomes in COPD. Of note, all these factors do not act on their own but interact with each other to influence the final result. Additionally, there are two other aspects to consider: the availability of resources and the organisation of care are also strongly associated with clinical outcomes. The supporting evidence is extensive and we can mention three examples. A study

that evaluated discharge records from 1999 to 2008 for 208 Californian hospitals aimed to determine the association between hospital spending and risk-adjusted inpatient mortality for each of the six following diagnoses at admission: acute myocardial infarction, congestive heart failure, acute stroke, gastrointestinal haemorrhage, hip fracture, and pneumonia[20]. It was shown that patients admitted to hospitals in the highest quintile of hospital spending had lower inpatient mortality than those admitted to hospitals in the lowest quintile. Another study from the University of California used data from a large tertiary academic medical centre involving 197,961 admissions and 176,696 nursing shifts of 8 hours each in 43 hospital units to assess the association between mortality and patient exposure to nursing shifts[21]. The authors found that a higher proportion of hours of nursing care provided by registered nurses was associated with better care for hospitalised patients. Finally, using data from the 2016 Global Burden of Disease (GBD) study, another analysis showed the mortality map due to low-quality health systems (Fig. 1)[22]. According to this figure, poor-quality healthcare contributed to the most deaths per unit population in South Asia and Central and West Africa. Using data from the 2016 GBD study, the authors were able to estimate that total low- and middle-income countries poor-quality mortality was 82 deaths per 100,000 population.

Importantly, the last group of variables associated with clinical outcomes is directly related to clinical practice. It has been pointed out that the way we deliver care as healthcare professionals also plays a key role. Notably, the complexity of healthcare itself and the rapid and constant changes in technology and therapies may generate uncertainty in decision-making and may end up determining different forms of clinical practice. Currently, there is extensive evidence that there is a gap between the medical care that patients receive and the recommended practice. In both primary and secondary care, there are unjustified variations in practice and outcomes, which cannot be explained by the characteristics of patients. In COPD, this phenomenon has been clearly shown after the results of various clinical audits[23-26]. The Clinical Audit of Patients Admitted to Hospital in Spain due to Exacerbation of COPD (AUDIPOC Study) identified large between-hospital variations in care and clinical outcomes[27]. The authors evaluated all different potential explanatory variables and found that variables representing patients' clinical conditions were stronger predictors of clinical outcomes than resources and organisation of care variables.

To make things more complex, AUDIPOC demonstrated a noteworthy reduction in the observed crude between-hospital variation in outcomes after accounting for the so-called hospital-cluster effect. This cluster effect indicates that patients with similar characteristics may experience different processes of care and outcomes, depending on the hospital to which they are admitted because they are subject to distinct common contextual influences[28]. The cluster effect acknowledges that all patients admitted to any given hospital for a specific clinical issue would get similar care, which might in turn be different from those delivered by another institution. This phenomenon may be explained by the existence of specific hospital-linked factors. Such variables may include, but are not limited to, socioeconomic status, demographics,

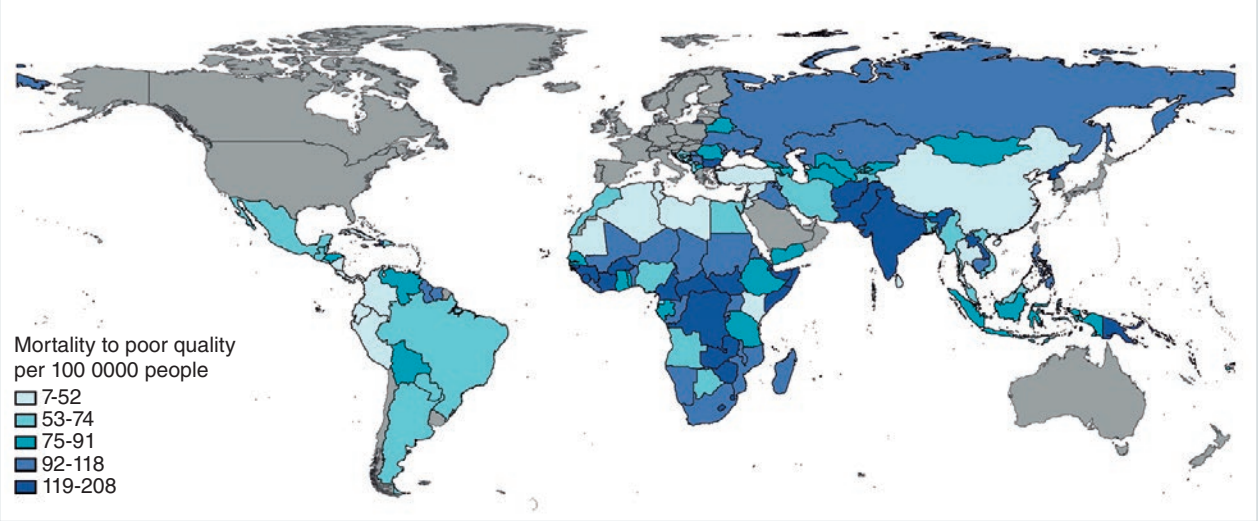

Figure 1. Mortality due to poor-quality healthcare by country *(reproduced from Kruk ME et al.[22], http://dx.doi.org/10.1016/S0140-6736(18)31668-4, available under the terms of the HYPERLINK http://creativecommons.org/licenses/by/4.0/ (CC BY). No modification of the original figure has been made).*

environmental characteristics, usage of health services and clinical practice styles. Therefore, such differences among distinct participating hospitals (i.e. cluster effect) might exert a significant influence on outcomes.

HOW TO DEAL WITH CLINICAL PRACTICE VARIABILITY?

From the arguments alluded to, we can surmise that the variability of clinical practice is considerable and that the number, types and levels of the variables that might explain this variability are enormous. Accordingly, there is a need for tools that allow the control of this variability in the context of the clinical circumstances with the final aim to provide a more uniform clinical practice adapted to the concrete needs depending on the setting and circumstances.

The generation of clinical practice guidelines showing recommendations for clinical practice with the perspective of evidence-based medicine constitutes one of these initiatives that contributes to the improvement of the quality and the equity of healthcare. Evidence-based medicine aims to ensure that clinical decisions are made on the basis of the most up-to-date, solid, reliable, and available scientific evidence. The advantages of this approach are obvious: evidence-based practice allows us to search the best available treatment for our patients, to optimise the decisions through our clinical judgement, generate and demand continuous investigation, confer protection against lawsuits, and base decisions on substantiated scientific data[29]. However, a number of limitations have been pointed out: evidence-based practice may denigrate clinical judgment, it does not apply to care of individual patients, advocates a slavish, "cook-book" approach to treatment, ignores patient's values and preferences, and requires solid data to make decisions; therefore, if there is no data, no recommendations can be given[29,30].

Another approach is the management by the so-called integrated healthcare processes. This is a form of clinical management that coordinates health resources to generate integrated care pathways, aiming to achieve an integrated care with a longitudinal and continuous view[31]. Although the approach may result convenient and logical for reducing the variability, the process of implementation of the different policies diverges in practice, with three main limitations: 1) the limited use of power to resist to change, 2) the unstable level of internal communication among the professionals involved, and 3) the poor learning process by both the professionals and policy makers[32,33].

In this context, the Chronic Care model[34] is widely accepted as a conceptual framework to effectively address the burden of non-communicable diseases, with integrated care services being one of its core components. Again, the practical deployment and extensive adoption of integrated care remain a challenge. In this regard, a recent study showed high potential to enhance health outcomes with cost-containment for four articulated integrated care services supported by information technologies, namely home-based long-term maintenance of rehabilitation effects, enhanced care for frail patients, home hospitalisation and early discharge, and support for remote diagnosis in primary care.

CLINICAL AUDITS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE: WHAT FOR?

In this context, clinical audits emerge as a tool to improve healthcare[36,37]. According to the World Health Organization, a clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change[38]. Far from merely being a systematised procedure for retrospective recovery of clinical data and the available resources for evaluating professional performance and associated factors, clinical audits are a process of continuous improvement in healthcare by evaluating the health system and its professionals. Analogously to the Plan-Do-Check-Act (PDCA) Deming cycle[39], a cycle of the clinical audit can be defined (Fig. 2)[38]. Therefore, although not exempted from methodological considerations that may need an adaptation to each specific clinical context, clinical audits are presented as a collaborative working tool that seeks to collect information with the idea of showing this information to the audited professionals, so that it serves to improve healthcare.

CLINICAL AUDITS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE: SOME KEY FINDINGS

As alluded to above, there is a clear need to perform clinical audits in a disease such as COPD. Epidemiological data of the disease places it as a first-magnitude disease. With a prevalence of around 10%[2,6], on the rise[40], and with a considerable mortality[41,42] and impact on sanitary budgets with direct costs ranging from 504 $/patient/year to 9,981 $/patient/year in different countries[43], COPD has become a world health problem.

Until recently, clinical audits for COPD were not frequently carried out. Over the last few decades, the United Kingdom[44], followed by

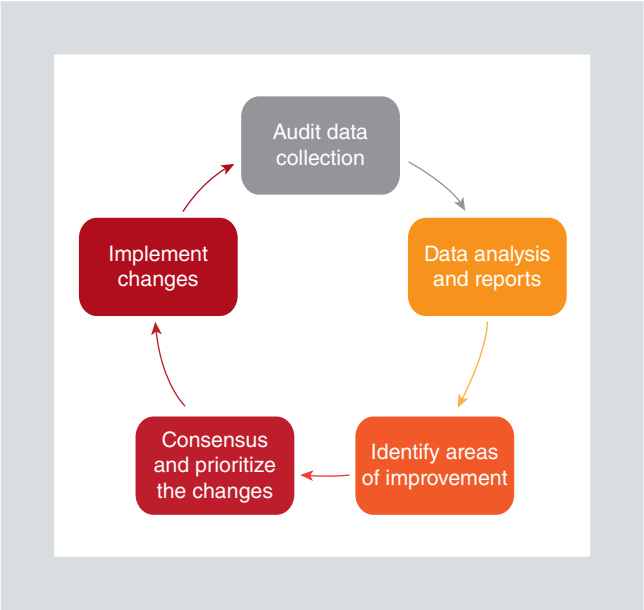

Figure 2. The audit cycle.

Spain[45,46], has been leading the audit process for COPD in Europe. Additionally, several countries have started their own audit projects[47,49], such as the European COPD Audit in 13 European countries[50,51] (Fig. 3). In Spain, the AUDIPOC network evaluated clinical care in patients hospitalised due to COPD[27] and recent initiatives have explored the clinical performances in specialised respiratory outpatient clinics[26]. These audits have provided valuable information about medical interventions in hospital wards for patients admitted for COPD exacerbation[51], the resources available[52], and the interrelationship between resources and clinical practice[26,27]. Additionally, clinical audits in primary care are starting to emerge providing valuable data on how to improve clinical care[24,53]. To review in detail all the data obtained as a consequence of these audits would be long and complex. However, it might be appropriate to review some of the most relevant messages from these clinical settings.

Clinical audits during chronic obstructive pulmonary disease admissions

During the admissions, the European COPD Audit provided relevant information on clinical practice. The distribution by sex depicted a picture of male predominance. However, the United Kingdom was the one country in which the number of women admitted due to COPD exacerbation over exceeded the number of men (Fig. 4A). This is probably reflecting the initiation of the COPD epidemics in women expected to come in the next few coming years due to the incorporation of women to tobacco smoking[54].

Another key relevant aspect was the number of current smokers. According to the European COPD Audit data, 33% of those admitted for COPD exacerbation still continued to smoke at the time of admission (Fig. 4B). This finding is striking since we are talking about a disease directly related to tobacco use and in a clinical situation of exacerbation severe enough to be admitted to the hospital. Notwithstanding, a considerable number of cases were active smokers[55]. This data must be a sign of alert and highlights the opportunity that the hospital admission should represent to advance in the process of smoking cessation putting into value the intra-hospital programs for smoking cessation[56].

The evaluation of the spirometric data in patients admitted for COPD exacerbation is quite alarming. Despite being discharged by senior clinicians in specialty hospitals, 69% of the cases discharged with a diagnosis of COPD exacerbation had no spirometry in their medical history (Fig. 5A). More strikingly, 13.5% of the registered spirometries did not show an obstructive pattern (Fig. 5B). These cases cannot

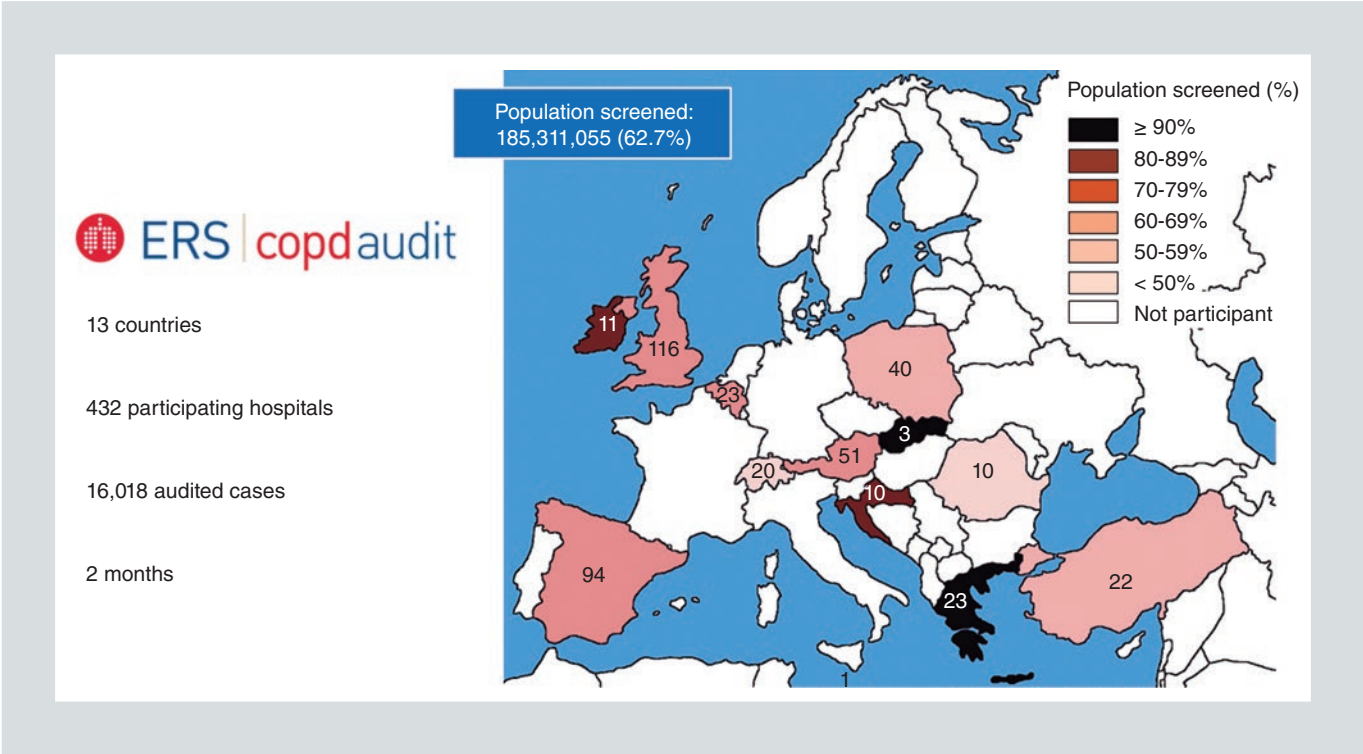

Figure 3. Participating countries with number of centres in the European COPD Audit.

be diagnosed of COPD and should therefore not have been discharged with a diagnosis of exacerbation of COPD. The data open two important debates: on the one hand, there is a need to have the diagnosis of COPD secured before giving a diagnosis of exacerbation; on the other hand, assuming that a number of patients who are admitted to hospital do not have a pre-admission study, hospitalisation could be established as an opportunity to confirm this diagnosis. Although this may seem controversial, a recent study conducted in Spain assessed the role of spirometry performed during admission the day before discharge from hospital[57]. The authors found that a considerable number of patients did not go to the follow-up visit after admission and that pre-discharge spirometry could change severity with respect to follow-up, but it did not change the diagnosis of airflow limitation[57]. In this sense, the debate on the usefulness of pre-discharge spirometry is not closed as yet.

Regarding therapies for the exacerbation, the European COPD Audit revealed two key areas for improvement. The first is related to the use of pulmonary rehabilitation programs after admission. According to the European data, only 50.2% of cases received this type of treatment after discharge (Fig. 6A). However, there is currently consistent evidence showing that pulmonary rehabilitation after exacerbations reduces re-admissions, hospital stay and mortality[58]. Interestingly, Spain is at the level of other countries that are not in our geographical environment of pulmonary rehabilitation availability (Fig. 6A). These differences between countries are likely to be related to the unequal distribution of resources in

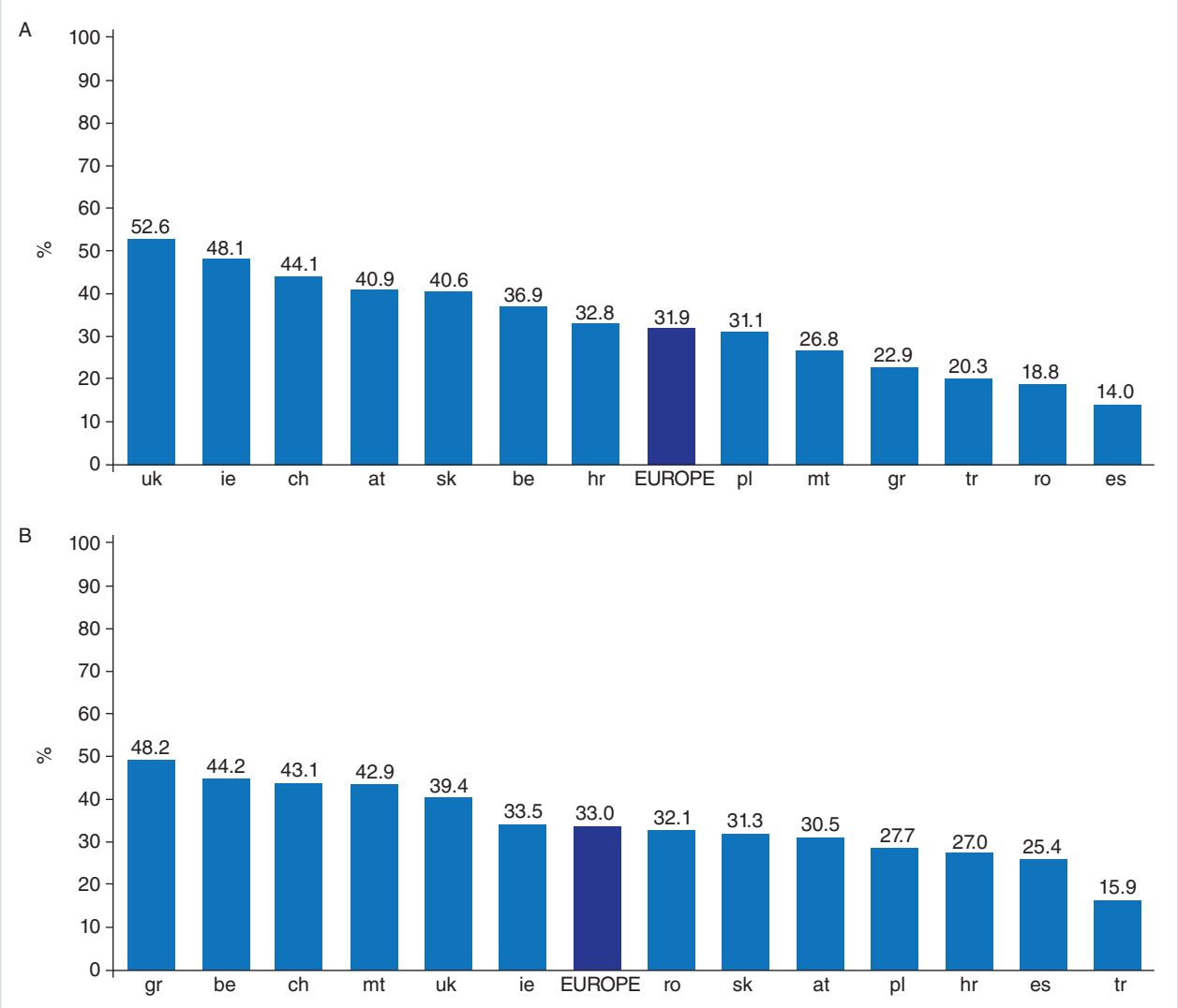

Figure 4. Percentage of women **(A)** and current smokers **(B)** admitted to hospital in the different participating countries in the European COPD Audit. Each country is identified by their internet notation in light blue. Dark blue represents the European average.
at: Austria; be: Belgium; ch: Switzerland; es: Spain; gr: Greece; hr: Croatia; ie: Ireland; mt: Malta; pl: Poland; ro: Romania; sk: Slovakia; tr: Turkey; uk: United Kingdom.

pulmonary rehabilitation in Europe as evidenced by a survey carried out by the network of European COPD audit centres[59].

The second aspect that needs to be stressed is the use of non-invasive ventilation in patients with acute hypercapnic respiratory failure with respiratory acidosis (Fig. 6B). According to the European audit data, this treatment was applied in 46% of the cases in which it was indicated. This figure is worrisome. For decades, consistent evidence of the clinical impact of non-invasive ventilation in these patients has been clear, describing benefits in number of intubations, hospital stay, intensive care units admissions and mortality[60,61]. The analysis of the reasons for

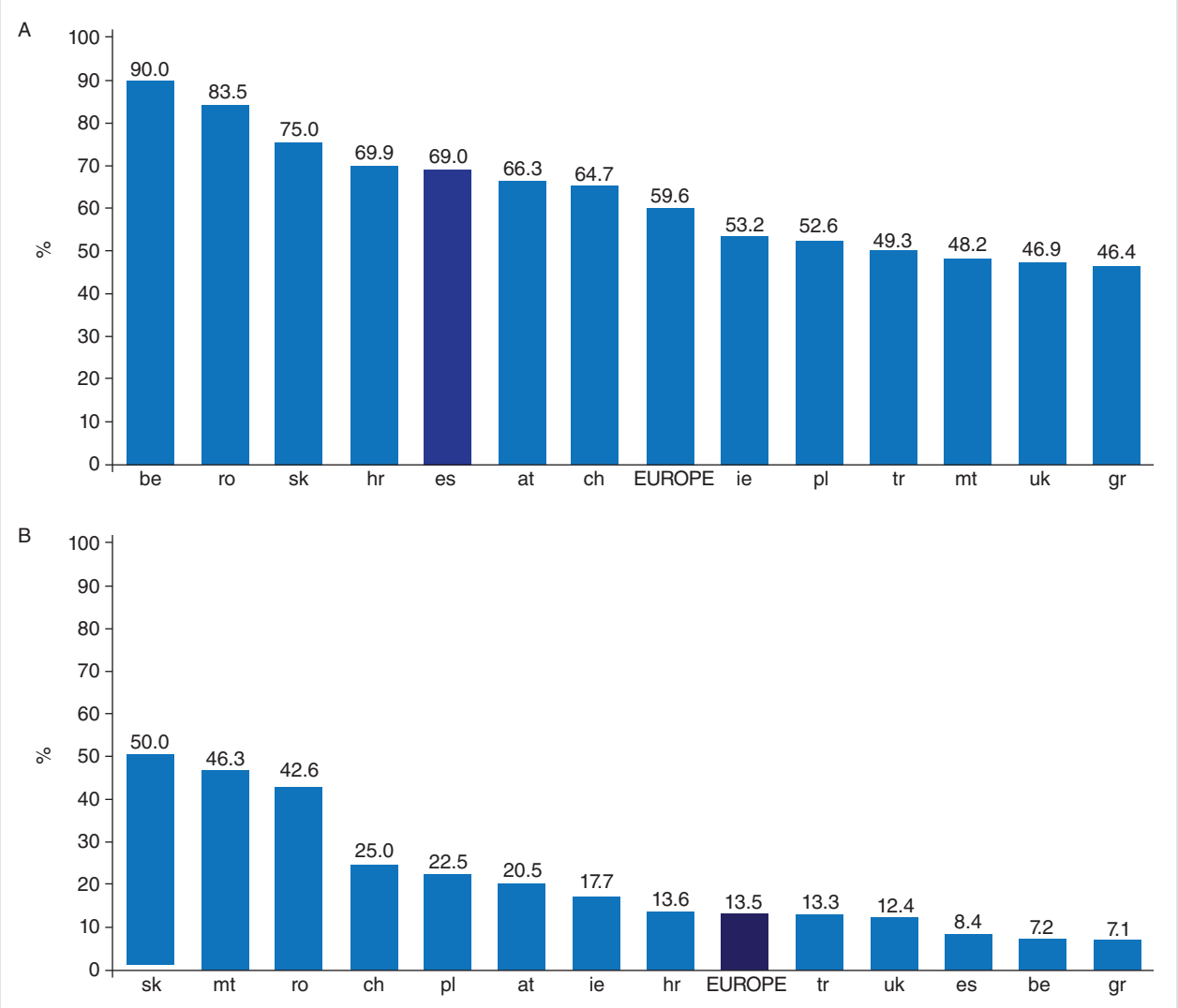

Figure 5. Percentage of cases with available spirometry **(A)** and those without an obstructive spirometric pattern **(B)** admitted to hospital in the different participating countries in the European COPD Audit. Each country is identified by their internet notation in light blue. Dark blue represents the European average.
For other abbreviations, see Figure 4.

this under-utilisation exceeds the objectives of this article, but this phenomenon has been described in previous studies and its clinical consequences are evident[62]. Respiratory intermediate care units have been proposed as the one solution for the evaluation and treatment of these patients with a significant positive clinical impact[63].

Clinical audits for chronic obstructive pulmonary disease outpatient care

Although there have been numerous initiatives that assess various aspects of outpatient COPD care, formal clinical audits have been smaller in number at this setting. In Spain, a first pilot clinical audit was conducted in Andalusia between

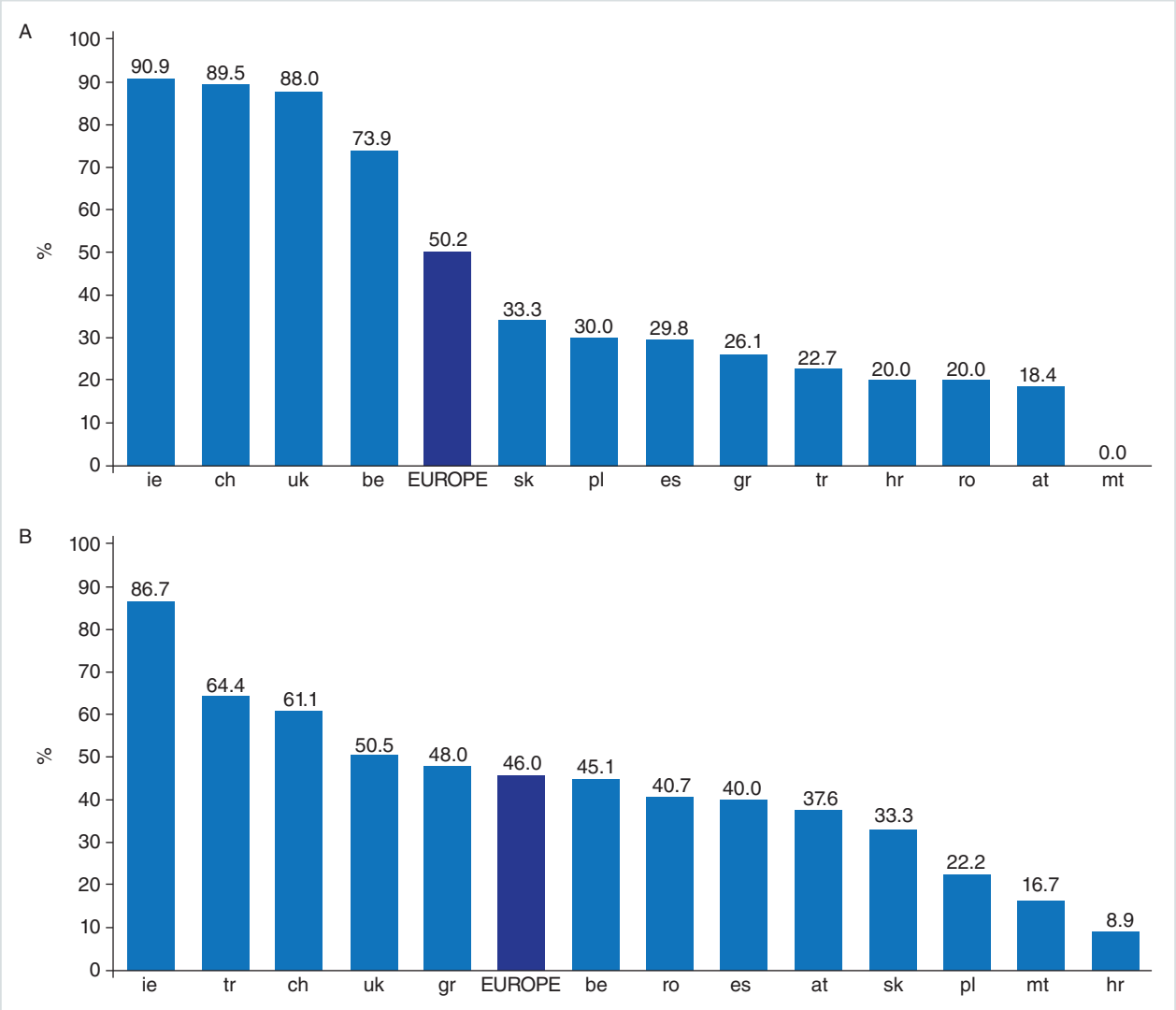

Figure 6. Percentage of cases receiving pulmonary rehabilitation after discharge **(A)** and those receiving non-invasive ventilation and pH < 7.35 **(B)** admitted to hospital in the different participating countries in the European COPD Audit. Each country is identified by their internet notation in light blue. Dark blue represents the European average.
For other abbreviations, see Figure 4.

2013 and 2014 and assessed ambulatory clinical care in 621 clinical records from 9 hospitals[64]. This audit was followed by two major national studies. The EPOCONSUL study, an observational cross-sectional study with prospective case recruitment in outpatient respiratory clinics, audited 4508 medical records between 2014 and 2015[65] and the DEsign and Local Implementation of Clinical Audits in different Types of Obstructive lung diseases (DELICATO) study evaluated 2551 records during the same period of time, providing an innovative perspective according to the fragility of the case.

These studies have provided information on different key aspects regarding clinical care including: an evaluation of the adherence to clinical practice guidelines and a study of their variability[26,65-67], they have helped us to understand the determinants guiding the clinical decisions of stepping up and down treatment in stable COPD[68,69], they have allowed us to evaluate changes in clinical practice in relation to annual seasonality[70,71], as well as to make specific evaluations of specific clinical scenarios[25]. Altogether, a list of strengths and weaknesses of clinical care for COPD outpatients can be obtained (Table 1).

Clinical audits for primary care

The information regarding how COPD patients are treated in the primary care setting is essential and would provide very relevant information on the process of care. It might also reveal the key areas wherein improvements are required in order to complete the picture obtained in secondary care audits. Therefore, formal clinical audits in primary care are emerging to evaluate clinical performance in this setting using a standardised methodology[53]. Additionally, although not formally labelled as clinical audits, previous analyses have been done describing different aspects of clinical performance in primary care using different methodological approaches[72-74].

The Community Assessment of COPD Health Care (COACH) study was an observational multicentre national randomised non-interventional clinical audit aimed at evaluating clinical practice delivered to COPD patients in primary care in Spain[24]. The results of this study indicate that there is considerable variability in clinical performance that cannot completely be attributed to the severity of the disease. Notably, most evaluated parameters were judged to fall under inadequate performance, except two (i.e. registration of influenza vaccination, and registration of exacerbations in the previous years), that were considered excellent.

In addition, COACH investigated COPD diagnosis in primary care, quantifying the degree of inaccurate diagnosis and assessing the associated factors at patient and primary care centre level[24]. As a result, the degree of accurate diagnosis in primary care was as low as 17.6%. Variables related to smoking status, lung function assessment, and some specific interventions were considered associated with an inaccurate diagnosis at the patient level. Additionally, complementary tests availability and different aspects of the resources available, like the presence of primary care trainees, the availability of a tobacco cessation unit or home nebulised therapy were also associated with inaccurate diagnosis at the centre level.

A recent review highlighted the possible clinical situations in which an inaccurate diagnosis of COPD could occur[75]. On the one hand, receiving inadequate healthcare[76], or suffering from an uncontrolled disease that may also impact on other comorbidities[77] are some of the consequences of under-diagnosis. On the other hand, over-diagnosis is another problem that frequently occurs in COPD. This over-diagnosis can impact on several key aspects of the disease[78], including an increased exposure to not-otherwise-needed pharmacological treatment, an increase in health services use for the wrong patients, and the performance of a number of diagnostic tests.

Table 1. Strengths and weaknesses of the COPD outpatient clinical care in Spain

	Appropriate measures	Measures to improve
Anamnesis	• Record dyspnoea grade • Record respiratory symptoms • Exacerbation risk evaluation	• Record of physical activity • COPD Assessment Test use
Complementary	• Simple radiology evaluation • Spirometry evaluation	• Alpha-1 antitrypsin determination • Quantification of emphysema by computed tomography • Cardiopulmonary exercise test
Diagnosis	• Correct diagnosis done	• GesEPOC phenotype • GOLD classification • Use of BODE/BODEx indexes
Treatment	• Use long-term bronchodilators • Tobacco recommendations • Exact dose of inhalers recorded	• Flu vaccine recommendation • Pneumococcal vaccine recommendation • Exercise recommendation • Adherence evaluation • Adverse effects evaluation

BODE index: Body-mass index, airflow Obstruction, Dyspnoea, and Exercise; BODEx index: BODE and severe Exacerbations; COPD: chronic obstructive pulmonary disease; GesEPOC: Spanish COPD guidelines; GOLD: Global initiative for chronic Obstructive Lung Disease.

Additionally, people may be urged to adapt their lives for a disease they do not have, with regular unneeded monitoring which finally labels them as sick people. Finally, it clearly impacts on the health system leading to potential extra costs.

This scenario is clearly influenced by the availability and performance of spirometry in primary care. The latter investigation in a stable clinical situation, at rest, and with a bronchodilator test is essential to confirm the diagnosis[79]. Unfortunately, the confirmation of this diagnostic criterion in primary care is far from optimal in Spain. A study conducted in Spain evaluated the availability and frequency of performing spirometry in primary care in Spain[80]. The study revealed that most health centres had a spirometer. However, the frequency of performing spirometries was 5.6 per week with a range between regions of 2.0 to 8.8 spirometries per week for the study of airway diseases. Considering the prevalence of COPD, asthma and bronchiectasis, the three main chronic airway diseases by frequency, it can clearly be concluded that the frequency of spirometry in primary care remains insufficient.

CONCLUSIONS

Clinical audits emerge as an overarching tool that aims to improve healthcare. Far from being merely a systematised procedure for retrospective recovery of clinical data and the available resources for evaluating professional performance and associated factors, clinical audits are a dynamic, continuous updating process that gives feedback and has the ultimate goal of improving healthcare.

Previous audit studies have shown two main learning points. First, auditing is possible. Despite the initial apparent complexity that implies having to work with different information systems from the different centres and in diverse settings, we and others have shown that it is possible to register and to evaluate the

healthcare by a clinical audit. Unfortunately, this effort is currently done only in the context of research studies. However, it would be necessary for both clinicians and healthcare managers to understand that auditing should be part of their daily regular clinical work, as is already the case in countries such as the United Kingdom. Today, it is not reasonable that a profession with a high social impact such as medicine does not count on the evaluation and continuous improvement of their professionals performance as part of its daily work.

Second, we can always improve our practice. Although all health professionals involved in the care of the COPD patient provide the best possible care in the context of the resources available, we can always improve. The results of the audits show a hopeful scenario with numerous indicators of excellent healthcare, but also with notable areas of improvement. In the future, clinicians and health managers should work hand in hand so that we can overcome these limitations and provide the best possible clinical care for patients with a chronic disease with high impact for the patients and their families, such as COPD.

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