European Journal of Public Health, 2025, ckaf065

https://doi.org/10.1093/eurpub/ckaf065

Changes in mental health diagnosis and healthcare use in seven European countries before and during the COVID-19 pandemic (2017–21)

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Abstract
In the framework of the European Population Health Information Research Infrastructure (PHIRI) project, we analysed the healthcare use for depression and/or anxiety during the coronavirus disease 2019 (COVID-19) pandemic. Aggregated monthly number of diagnoses were obtained from electronic health records and databases in Austria, Estonia, Finland, Latvia, Romania, Wales (UK), and Aragon (Spain) and analysed using the PHIRI federated research infrastructure. Rates of diagnosis, prescriptions and visits to primary care, hospital or emergency department were calculated by 10 000 population. Segmented Poisson regression to estimate changes in outcomes after the COVID-19 pandemic declaration was produced controlling for baseline levels and trends for the period January 2017 to December 2021. Following pandemic declaration, level change of incident diagnoses fell in Romania, Aragon (Spain), and Wales (UK) [log rate −0.853 (95% confidence interval −1.045 to −0.661), −0.338 (−0.434 to −0.242), and −0274 (−0.365 to −0.183), respectively]; level change of visits to primary care decreased in Romania and Wales (UK) [−0.347 (−0.555 to −0.138) and −0.272 (−0.368 to −0.177), respectively], and increased in Latvia [0.065 (0.004–0.126)]; level change for hospital admissions diminished in Latvia, Romania and Wales (UK) [−0.206 (−0.393 to −0.019), −0.947 (−1.143 to −0.752) and −0.116 (−0.202 to −0.030), respectively]; and level change of visits to emergency units fell in Latvia and Romania [−0.290 (−0.429 to −0.151) and −0.865 (−1.040 to −0.690), respectively] and increased in Aragon (Spain) [0.880 (0.259 to 1.502)]. COVID-19 pandemic declaration altered the use of mental health resources. This study highlights the potential use of harmonized data for providing evidence for future pandemic preparedness.

Additional content

Additional content An author video to accompany this article is available at: https://oup.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=63cbd437-28d8-476f-8040-b2d10121263c.

Introduction

The COVID-19 pandemic and the measures to contain it have caused an increase in the risk factors that lead to mental health problems, such as inequality and unemployment, among others [1]. Holmes *et al.* warned about a rise in anxiety and depression symptoms and suicidal behaviours in the general population in UK and launched a call for action to address this challenge [2]. Some groups, such as older people and healthcare workers, were especially vulnerable to the psychological consequences of the pandemic, but there was also evidence of mental health deterioration in the general population in several European countries [3–5]. A study in European countries found a decline in mental well-being since summer 2020, with 64% of younger adults at risk of depression [6].

Some authors have found that mental health problems increased during the lockdown, decreased in the immediate phase after it (summer 2021), and experienced a gradual increase as the pandemic lengthened [7]. However, in many European countries, the pandemic disrupted the provision of public services and led to unmet mental health needs for around 20% of European citizens [6].

The World Health Organization has recommended countries to monitor changes in mental health at population level through valid, standardized, and comparable measures and instruments [8]. Routine data collection of main indicators is essential to provide information about the diseases and the performance of the healthcare system and will help to evaluate the resilience of the healthcare system and to improve its quality. On the other hand, there is a need of harmonization of data to allow the comparability between systems and regions. The pandemic has highlighted the need of a structured European mechanism for the exchange of data that allow for organising and sharing health information between countries.

The project Population Health Information Research Infrastructure (PHIRI) [9] aimed to facilitate and support open, interconnected, and data-driven research by sharing cross-country population health information and exchanging best practices related to identification of data sources, access and reuse of data on COVID-19. The PHIRI project followed the best ethical and data protection practices that ensured patient privacy without hindering research when sharing sensitive health and genomic data for research reuse, following Ethical, Legal and Social Issues practices [10] and promoting the capacity of computational systems to find, access, interoperate, and reuse (FAIR) data with none or minimal human intervention (FAIR principles) [11].

The present work aimed at describing changes in mental health in the European population related to the COVID-19 pandemic by analysing diagnoses, prescriptions, and visits to healthcare related to depression and/or anxiety.

Methods

This research project was carried out using the PHIRI federated research infrastructure (FRI), a network with a coordination node that orchestrated the workflow and the communication between various nodes who had access to their local health data. In this FRI, the coordination node implemented and containerised the analytical pipeline in a stand-alone application that was locally deployed for each node. The nodes ran the application on their datasets following an agreed common data model (CDM) that have been previously published [12, 13]. Instead of individual patient data, the local nodes returned aggregated data to the orchestrating node.

Data collection

Data from 2020 to 2021 period was compared with data from 2017 to 2019. Patients aged 18 years or older who contacted the healthcare system during 2017–20 (2021 whenever possible) were included for analysis. The CDM specification supporting this study and the analyses pipeline are publicly available at Zenodo [12, 14].

Outcome measures were monthly rates by 10 000 population of (i) incident diagnosis of depression and/or anxiety, (ii) prescriptions of antidepressants and/or anxiolytics, and (iii) visits to primary care, hospital, or emergency department, respectively. A washout period of 1 year was set to consider an incident diagnosis of depression or anxiety instead of part of a previous episode. Primary diagnoses and visits or admissions to a hospital unit or emergency were classified using codes F32–34 (International Classification of Diseases, ICD-10) for depression; and code F41 (ICD-10) for anxiety. Admissions were the only type of visits to the hospital reported by Latvia, Romania, and Wales. For drug prescription, the British National Formulary (BNF) codes 40301, 40302, and 40303 (depression related drugs) and 40102 (anxiolytics) were used by Wales. For coding visits to primary care, International Classification of Primary Care (ICPC) P76 and P74 codes were used for depression and anxiety, respectively. Romania, Estonia, and Latvia reported visits to primary care using the abovementioned ICD-10 codes. Wales used NHS read codes from their GP diagnosis records, which were cross-referenced with the ICD-10 codes specified.

Data were provided by nodes representing seven health systems: Austria, Estonia, Finland, Latvia, Romania, Wales-UK, and Aragon-Spain (Supplementary Material S1). A description of the health systems and mental health services for each node can be found in Supplementary Material S2.

Data analysis

Monthly trends were obtained using aggregated data from each node. Rates of incident primary diagnosis, prescriptions and visits were calculated by 10 000 population from the total number of inhabitants for each country/nation/region and year. Population counts were obtained by year from the United Nations for the country nodes [15]. Mid-year population estimates by local authority and year were obtained for Wales [16]. Population estimates from the continuous register (regional register) were retrieved for Aragon (Spain) [17].

Interrupted time series to estimate changes in outcomes after the pandemic by COVID-19 declared in March 2020 were produced while controlling for baseline levels and trends. Aggregated data points were modelled for each outcome of interest by month using segmented Poisson regressions with robust standard errors [18]. Coefficients were displayed as the result of Poisson loglinear models: log(rate) = intercept + Monthly trend + Level change + Trend after pandemic declaration. Overdispersion of the models was estimated with the deviance statistic. Negative binomial regression models were used when the deviance of Poisson models was higher than 1.

Seasonality was checked for cycles of 12, 6, 4, or 3 months by including sine and cosine functions into the models, e.g. to define a variable 'season' of 12 months in these models, it is hypothesized that the seasonal pattern follows a cosine function with variable amplitude and horizontal shift. The cosine function defines two periods: (i) the time period that describes the measure of monthly rates, such as monthly crude incident rates of depression/anxiety and (ii) the period represented by one cosine function, for this example the period of 12 months.

If the function of sine or cosine was a statistically significant predictor of the outcome for a specific period (e.g. 12 months), both functions were included in a fitted model. Eventually, a model could have more than one 'season' (e.g. 12 and 3 months).

In addition, plots were produced by representing monthly rates and line plots. Line plots were obtained by calculating cross medians and then using the cross medians as knots to fit a cubic spline. The resulting spline was graphed. Two splines represented trends of rates before and after the declaration of the pandemic. A third spline representing a counterfactual trend was depicted using predicted values for years 2020–21 obtained from the model fitted with 2017–19 true values and was used to show the expected progression of the trend if the restrictive measures after pandemic declaration had not been deployed. Analyses were conducted using Stata V.17 statistical software (StataCorp, College Station, TX).

Ethical issues

All nodes complied with the legal and ethical requirements in each country to access and use the datasets included in this study (Supplementary Material S3). Data were anonymized and aggregated at origin.

Results

A total of 1 961 700 incident diagnoses were accounted for in all countries in 2017–21 (Supplementary Table S1). Only Wales (UK) provided data on prescriptions ($N = 22\,250$). Visits to primary care, provided by all countries except Finland, amounted to 1 560 171. Hospital admissions were 694 589; and visits to emergency

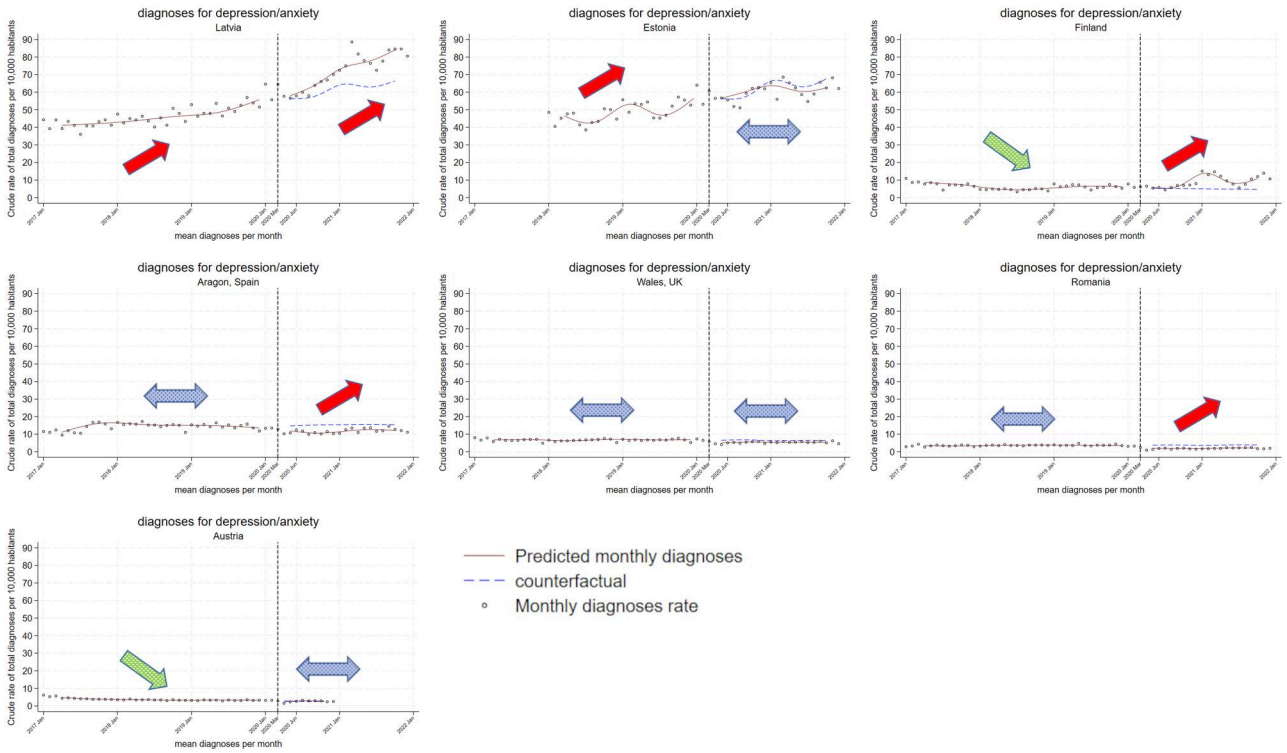

Figure 1. Effect of the pandemic declaration of COVID-19 in March 2020 on trends of rates of diagnoses of depression or anxiety by country, 2017–21.

departments related to depression or anxiety, available only in Estonia, Latvia, Romania, and Spain (Aragon), were 317 080.

Incident diagnosis

Figure 1 shows the temporal trends in incident diagnoses of depression or anxiety, during the study period, by node. Prior to pandemic declaration, monthly trends of depression/anxiety had diminished in two countries: in Austria, rates decreasing significantly by −0.014 every month [95% confidence interval (CI) −0.018 to −0.010] (Supplementary Table S2); and Finland, with estimated log rates decreasing every month by −0.007 (−0.013 to −0.002). On the other hand, Estonia and Latvia increased significantly their initial monthly rates (0.010, 0.007–0.014 and 0.009, 0.008–0.012, respectively).

Following the declaration of COVID-19 as pandemic in March 2020, a disruption in the countries with steady trends was observed, with an instantaneous reduction of diagnosed log rates: Romania, −0.853 (−1.045 to −0.661); Aragon (Spain), −0.338 (−0.434 to −0.242); and Wales (UK), −0.274 (−0.365 to −0.183) (Supplementary Table S2).

Monthly log trends in Finland reversed, compared with the pre-pandemic period, and increased significantly by 0.040 every month (0.026–0.055). Log rates of diagnoses increased slightly more than in the pre-pandemic period in Latvia (0.011, 0.007–0.015). Romania and Aragon (Spain) trends increased significantly their diagnosis log rates by 0.016 (0.003–0.030) and 0.007 (<0.001–0.013) breaking their pre-pandemic steady trends. There were no significant changes in Wales (UK) and Austria.

Prescriptions

Drug prescription trends are displayed in Supplementary Fig. S1 and Table S3. Prior to the pandemic declaration, monthly trends of antidepressants or anxiolytics kept steady in Wales (UK): −0.001 (−0.005–0.136) every month (Supplementary Table S3).

After the declaration of COVID-19 as pandemic in March 2020, a disruption was observed with a drop down of the log of prescriptions of −0.231 (−0.326 to −0.136) (Supplementary Table S3). Rates of prescriptions did not recover pre-pandemic levels (Supplementary Fig. S1).

Primary care visits

Prior to the pandemic declaration, monthly trends of visits to primary care for depression/anxiety in Austria decreased significantly by −0.015 every month (−0.020 to −0.010) (Fig. 2, Supplementary Table S4). On the other hand, Estonia and Latvia increased significantly their initial monthly rates (log rates increasing by 0.011, 0.008–0.014 and 0.008, 0.006–0.011, respectively).

After the declaration of COVID-19 as pandemic in March 2020, log rates of visits to primary care in Latvia rose by 0.065 (0.004–0.126) while countries with pre-pandemic steady trends observed reduced log rates of visits to primary care, i.e. Romania and Wales (UK) −0.347 (−0.555 to −0.138), −0.272 (−0.368 to −0.177), respectively (Fig. 2, Supplementary Table S4).

Austrian monthly trends increased significantly by the log of 0.054 every month (0.002–0.106); in Latvia, they doubled compared with trends in pre-pandemic period (0.019, 0.015–0.023); in Romania, a six-fold increase was observed, i.e. 0.023 (0.009–0.037) while Spanish log rates decreased by −0.041 (−0.062 to −0.020). Wales (UK) experienced an increase but not statistically significant (0.007, <0.001–0.015).

Hospital visits and admissions

Prior to pandemic declaration monthly trends of hospital visits and admissions due to depression/anxiety in Austria diminished (log rates decreasing significantly by −0.014 every month; −0.019 to −0.009) (Fig. 3, Supplementary Table S5). Monthly log rates diminished in Wales (UK) (−0.003, −0.005 to −0.001).

For hospital admissions at the month of the declaration of the pandemic, Latvia, Romania and Wales (UK) log rate significantly decreased to −0.206 (−0.393 to −0.019), −0.947 (−1.143 to −0.752) and −0.116 (−0.202 to −0.030), respectively (Fig. 3, Supplementary Table S5). Changes were not statistically significant in the rest of the countries.

After March 2020, Estonian trends changed from growing pre-pandemic hospital visits and admissions by 0.010 (0.007–0.014) to shorten by −0.006 (−0.011 to −0.001) during the pandemic time.

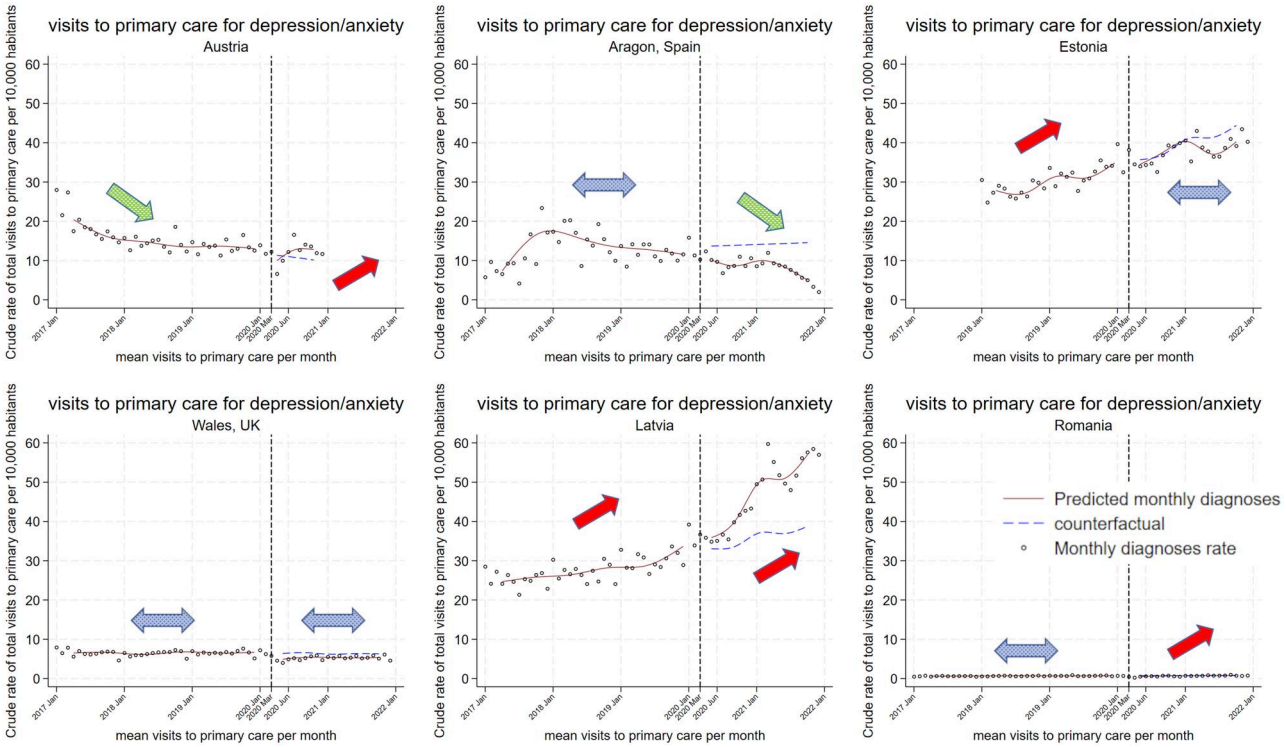

Figure 2. Effect of the pandemic declaration of COVID-19 in March 2020 on trends of rates of visits to primary care due to diagnoses of depression or anxiety by country, 2017–21.

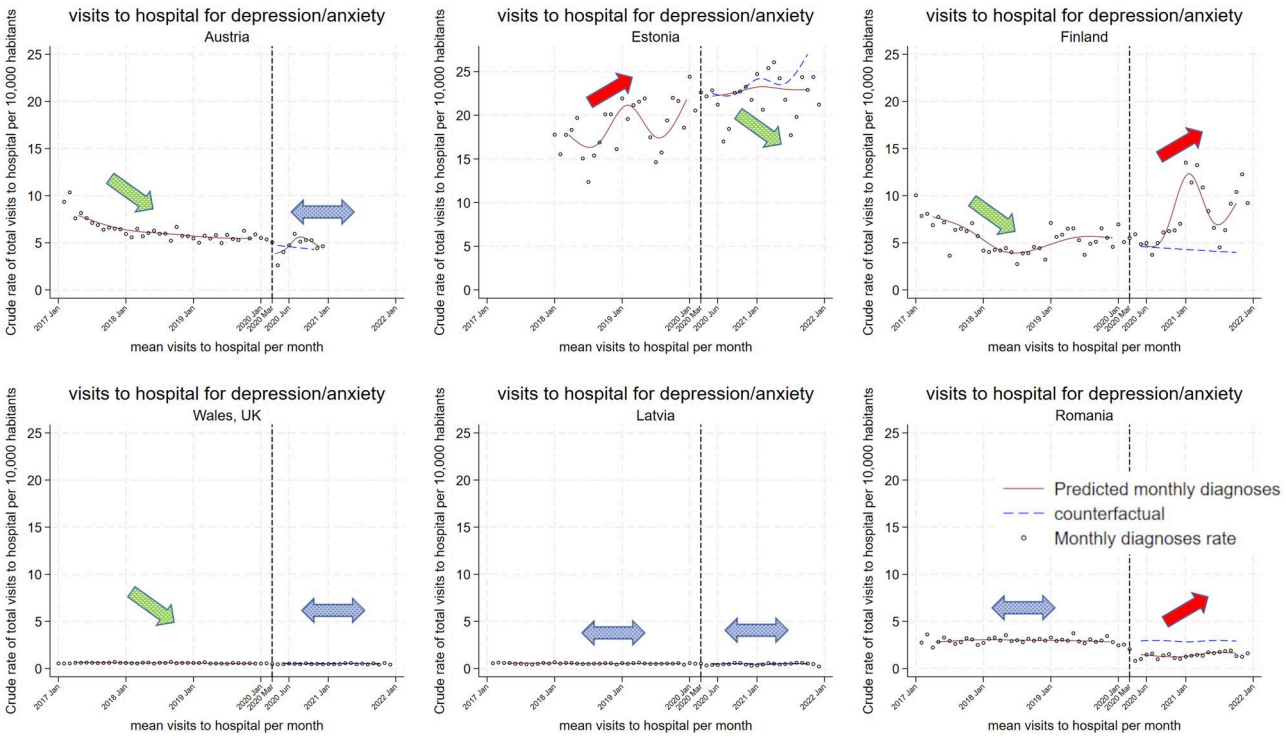

Figure 3. Effect of the pandemic declaration of COVID-19 in March 2020 on trends of rates of visits to specialized care or hospital or hospital admissions due to diagnoses of depression or anxiety by country, 2017–21.

Finnish trends turned from decreasing pre-pandemic log rates, i.e. −0.009 (−0.015 to −0.003) to growing rates after pandemic declaration, i.e. 0.040 (0.025–0.056); and Romanian log rates incremented by 0.020 (0.006–0.035).

Emergency department visits

Prior to pandemic declaration, monthly trends of hospital visits due to depression/anxiety in Latvia diminished (log rates decreasing significantly by −0.005 every month; −0.007 to −0.001), as in Aragon (Spain) −0.057 (−0.079 to −0.035) (Fig. 4, Supplementary Table S6).

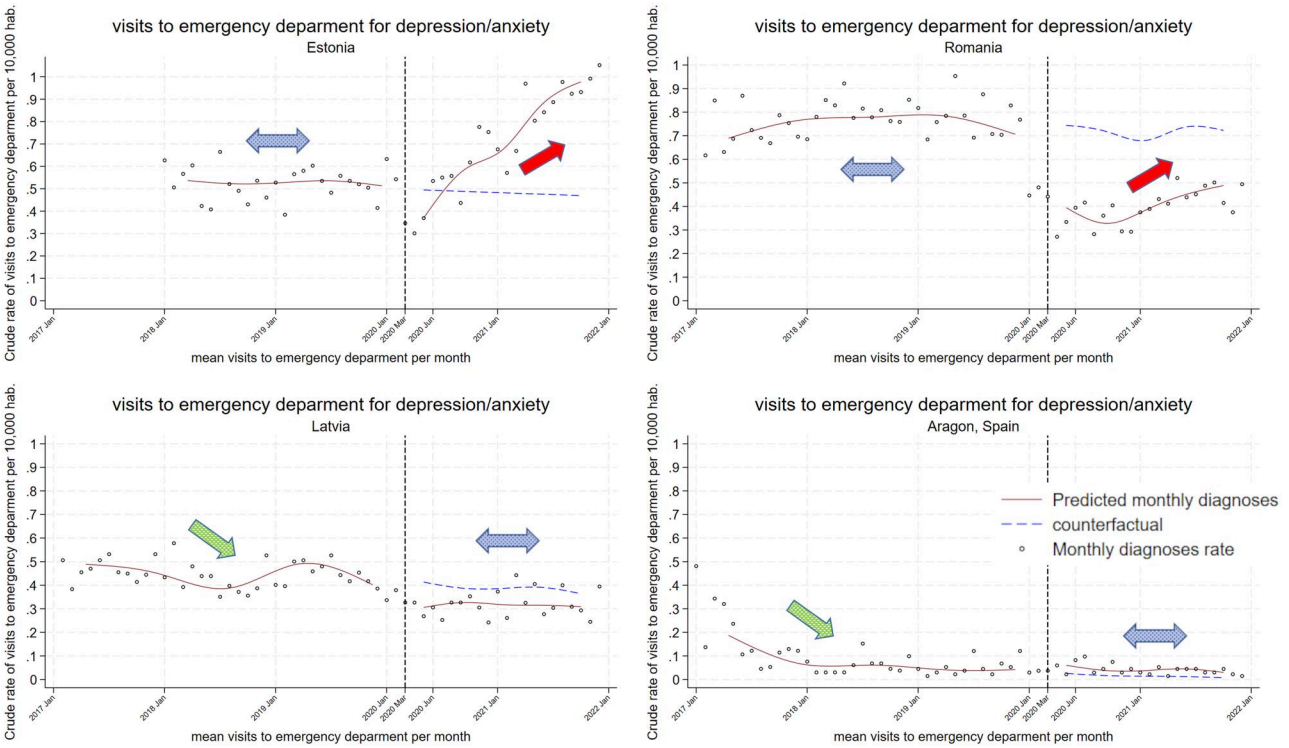

Figure 4. Effect of the pandemic declaration of COVID-19 in March 2020 on trends of rates of visits to emergency departments due to diagnoses of depression or anxiety by country, 2017–21.

At the month of the declaration of COVID-19 as pandemic, Latvia and Romania log rate visits reduced by −0.290 (−0.429 to −0.151) and −0.865 (−1.040 to −0.690), respectively (Fig. 4, Supplementary Table S6). On the other hand, log rate visits to emergency departments in Aragon (Spain) increased by 0.880 (0.259–1.502). After the pandemic declaration, Estonian and Romanian trends significantly rose by 0.049 (0.036–0.061) and 0.023 (0.013–0.034), respectively.

Discussion

This observational study aimed at assessing the impact of COVID-19 on diagnoses and the use of mental health resources in several European countries. It used real-world data in a distributed way across seven European health systems, to produce information for action during a public health crisis (i.e. COVID-19 pandemic) in the framework of a FRI [9].

In our study, an instant impact of the pandemic declaration on diagnoses or in healthcare use was registered in several participating countries. We identified a fall in incident diagnoses and in visits to primary care related to diagnoses of depression or anxiety in Romania and Wales (UK), and in rate of prescriptions in Wales (UK); as well as a decrease in hospital visits in Latvia, Romania, and Wales (UK) and in visits to the emergency department in Latvia and Romania.

Countries showed different responses to the pandemic, i.e. in Finland, the lockdown was less strict than in other countries like Spain, and this may have had an effect in the findings. In addition, there were structural differences in how the participant countries managed mental health services. Depression and anxiety were mainly treated in primary care in Latvia, Aragon (Spain), and Wales (UK), while mental health was more likely to be treated in hospitals in Romania. Austria, and Estonia reported frequent use of the primary care and hospital levels respectively. Finland only reported from the hospital level with frequent use of these services.

Previous literature has showed an increase in mental health disorders as a consequence of COVID-19, especially in countries with tighter lockdowns [7]. Duration of lockdowns, fear of infections, feelings of frustration and boredom, inadequate supplies and inadequate information have been cited as direct causes for the rise in mental health problems during the pandemic [19, 20]. Lockdowns also produced a disruption in the provision of health services that can lead to barriers to accessing services and delays in diagnosis and treatment of mental health problems. Moreover, a systematic review found, in several European countries, a decrease in new diagnoses and mental health service use that did not return to pre-pandemic levels for some services [21].

Pre-pandemic trends of participating countries varied: declining in diagnosis in Austria and Finland, steady in Romania, Aragon (Spain), and Wales (UK), and growing in Estonia and Latvia. After the pandemic declaration, trends in diagnoses slightly changed except for Latvia (increasing trends before and after March 2020) and Wales (remaining steady before and after March 2020).

The distinct organisation of services to treat mental health conditions and the availability of data sources impede absolute comparison between countries. However, the step and trend changes observed after the declaration of the pandemic are important to understand its impact on population mental health. Different reasons may explain the divergences in trends among countries. For example, in Estonia, several non-strict lockdowns due to the different waves of COVID-19 were applied. Worrying about health or job losses was among the main reasons for the increased diagnosis of anxiety and depression. In this country, at the end of 2022, the wave of the delta variant was followed/replaced by the wave of the omicron variant. Uncertainty of the effects (how lethal) and the extent (affected age groups) of the omicron variant probably led to more anxiety and depression feelings [22].

In Austria, trends are overlaid by effects of healthcare reform, which aimed to shift patients from hospital to ambulatory care. The Austrian cohort had a previously documented diagnosis in a hospital, and the trend is therefore influenced by reductions in in-hospital capacities. In general, utilization data have limitations in detecting incident cases, the most important of these are coverage (necessity of a provided service, ability to access the service) and bias due to incentives of the primary documentation aim.

Rate of consultations to primary care due to depression or anxiety dropped in 2020 in some countries such as Wales (UK) and

Romania, and increased in Latvia. In Spain, the restrictions in access to healthcare settings lasted during 2021 due to the successive increases of COVID-19 incidence, generating barriers such as long waiting lists, postponed appointments and medical tests, as well as reduced access to medications [4, 23]. In Latvia, on the contrary, there was no interruption of in-person psychiatry care at any time during the pandemic [24].

COVID-19 has had an impact on visits to hospitals or specialized care for depression or anxiety, as evidenced in Finland and Romania. In this latter country, the results are consistent and logical considering the structure and functioning of the Romanian healthcare system, where psychiatric diagnoses are made within tertiary care units—most hospital visits are either for diagnostic purposes following an acute psychiatric event or for a relapse [25].

Regarding visits to emergency units, while in some countries such as Estonia, the data remained stable, others such as Latvia and Romania presented a disruption due to the pandemic declaration. A similar tendency was found in a study in the USA [26], but not in Italy [27] where the visits to emergency departments increased during the initial phase of the pandemic. Variables related to socioeconomic status, the type of mental disorder, and the health system characteristics could explain these differences, but further studies are needed to confirm these hypotheses.

Strengths and limitations

This study has some remarkable strengths: it allowed exploring the consequences of COVID-19 pandemic in mental health diagnosis and healthcare use of the European population using real-world data, which was reused in a homogenized, distributed way to facilitate the exchange of information and to generate scientific evidence. For diagnoses, we included a washout period to differentiate between incident and prevalent cases. Provided datasets were assessed using a script to ensure their quality and detect inconsistent distributions and outliers, allowing for robust models and estimations.

The main limitation of this study is related to the data availability, depending on the existing registries of the participating countries. The different data holders, the existence of fragmented data, disparities in governance and legal requirements, and variations in data sources and their coverage hampered cross-country comparisons. The diverse expertise and capacity in data nodes, especially IT, challenged obtaining data in this study.

Twenty public health institutions from 19 European countries expressed their interest in contributing to this study, but some were unable to participate because they could not provide some of the mandatory variables requested in the CDM on mental health, had limited staff availability, or data harmonisation was challenging.

To avoid the misclassification of depression and anxiety events by coding first and secondary diagnoses differently, we agreed to deal only with primary diagnoses.

Although the study of the impact of the COVID-19 pandemic on mental health outcomes such as symptoms or functioning is relevant, in this study, we used outcomes that are commonly available in a standardised way in administrative and health registries, mainly diagnoses and healthcare utilization. For some outcomes, such as prescriptions, data were not available in most participating countries.

This study presents crude rate although stratification variables (sex, age band, and socioeconomic status) were provided by some countries. However, not all the participant could provide the same level of stratification, e.g. Estonia, Latvia, and Romania had not data on socioeconomic status and Wales (UK) was not able to provide data grouped by sex, age bands, and quintile of deprivation because many groups had fewer than five individuals, hence adjusted rates could not be estimated.

The pre-pandemic period included just 3 years. Graphs with longer pre-pandemic series could have captured seasonality more precisely in Finland, Aragon (Spain), and Wales (UK). For two participant countries (Austria and Estonia), series were shorter than the 2017-21 period. The number of months analysed was more than double of 12 months recommended before and after the intervention [18]. The number of emergency department visits was less than 100 recommended to achieve enough variability within some months for Spain, Estonia, and Latvia. Data sources did not distinguish whether the visits were in person or digital. In 2020 and 2021, an increase in online consultations during the pandemic, especially during lockdowns, could be assumed.

Conclusions

In conclusion, the results of this study showed the impact of COVID-19 pandemic on mental health diagnoses and the use of healthcare resources in the European population.

We can draw some implications for public health management and preparedness for future health crises from our results. Building a CDM is a time consuming, iterative process that requires harmonization of data sources. Health systems differ substantially across countries, thus further analysis of the mechanisms of dealing with the pandemic are required. Re-using administrative data for secondary purposes needs agreement on common definitions and plan enough time to obtain data.

Acknowledgements

We thank statistical experts from the National Centre of Epidemiology (Spain), Inmaculada León Gómez, Lorena Simón Méndez and Silvia Galindo Carretero for their advice with interrupted time series, controlling autocorrelation using a parametric approach, and interpreting Poisson models.

Supplementary data

Supplementary data are available at *EURPUB* online.

Conflict of interest: None declared.

Funding

This study was partially funded by grant from Aragonese Government funding programme 2023-2025 Orden CUS/1638/2022, de 8 de noviembre (Grupo B02_23R).

Data availability

Aggregated data used to develop the models is available upon request.

Key points

- We analysed the impact of COVID-19 pandemic on the use of mental health resources in several European countries, using a European federated public health data infrastructure fed with real-world data from health registries.
- We observed disruptions in healthcare resources use due to depression and anxiety between March and April 2020 in most participant countries. Although some countries returned to the pre-pandemic levels, the impact for others lasted until 2021.
- For re-using administrative data for secondary purposes, an agreement on common definitions, enough time to obtain data, and understanding the differences in mental health service structure across the participating countries are needed.

Disclaimer

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European Journal of Public Health, 2025, 00, 1–7
https://doi.org/10.1093/eurpub/ckaf065
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