



# Temporal trends in hospitalizations due to diabetes complications during COVID-19 pandemic in Andalusia, Spain

Eduardo Mayoral,<sup>1</sup> Reyes Ravé,<sup>2</sup> Pablo Rodriguez de Vera,<sup>2</sup> Gemma Rojo-Martinez,<sup>3</sup> Gabriel Oliveira,<sup>3</sup> Manuel Aguilar-Diosdado ,<sup>4</sup> Antonio León-Justel,<sup>5</sup> Maria Asuncion Martinez-Brocca <sup>1,2</sup>

**To cite:** Mayoral E, Ravé R, Rodriguez de Vera P, *et al.* Temporal trends in hospitalizations due to diabetes complications during COVID-19 pandemic in Andalusia, Spain. *BMJ Open Diab Res Care* 2022;10:e002623. doi:10.1136/bmjdr-2021-002623

Received 24 October 2021  
Accepted 6 March 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

## Correspondence to

Dr Maria Asuncion Martinez-Brocca;  
masuncion.martinez.sspa@juntadeandalucia.es

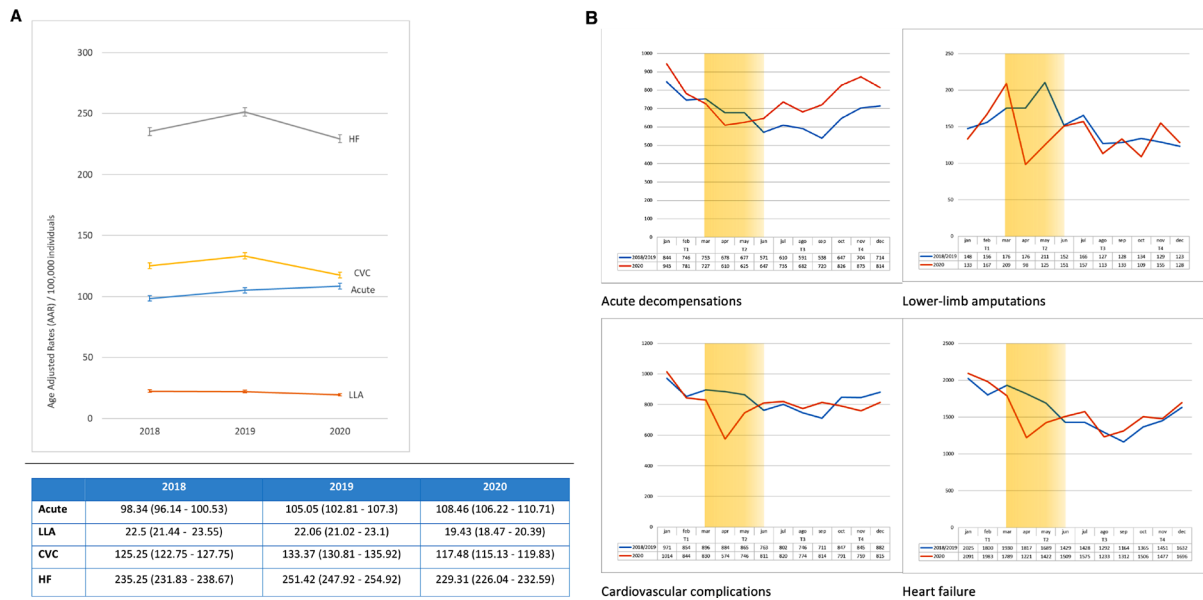
From March 14 to June 21, 2020, a global lockdown due to COVID-19 pandemic was implemented in Spain as a whole, including the Andalusian region. Andalusia encompasses a very populated area in Southern Spain (8.4 million), with a significantly higher diabetes mellitus (DM) prevalence rate compared with the rest of the country (15.3% vs 12.5%).<sup>1</sup>

The aim of the present study was to analyze whether the hospital admission pattern related to main DM complications in Andalusia has changed during the COVID-19 pandemic (year 2020). A population-based study of all monthly hospital discharges as well as the annual age-adjusted-admission rates (AARs) of patients with DM due to acute decompensations (AD) (ketoacidosis, diabetic hyperosmolarity syndrome, hyperglycemia), lower-limb amputations including forefoot amputations for diabetic foot ulcers (LLA), cardiovascular complications (stroke, acute myocardial infarction) (CVC) and heart failure (HF) in all individuals with a diagnosis of DM in Andalusia was conducted. Total number of discharges was obtained from the minimum basic data set (CMBD) at hospital discharge and the population from the user database of the Andalusian Public Health System. Discharges summaries include main diagnosis (cause of hospitalization) and secondary diagnosis (diabetes and/or other comorbidities). Outcomes were identified through specific codes for patients with diabetes from the International Statistical Classification of Diseases, 10th revision (ICD-10) applied to any diagnostic field of the CMBD. The E08-E13 codes from the ICD-10 were used at any diagnostic field of the CMBD to identify all patients with DM. A total of 92,720 (year 2020), 101,622 (year 2019) and

97,207 (year 2018) discharges of patients with DM were identified. This study was approved by the Ethics Committee of the University Hospital Virgen Macarena (IC 1409-N-20). AARs were calculated by the direct method of rate standardization, using the 2013 European standard population as the reference population. Data were then compared with the previous 2 years.

Our study shows that during 2020, there was an increase in AAR due to AD and a decline in the remaining DM complications ([figure 1A](#)). Likewise, different temporal patterns in admission rates were identified, based on the time period and the type of complications analyzed ([figure 1B](#)). During the lockdown period, a decrease in hospital admissions due to DM complications was observed, although less evident for the AD. This decrease was followed by a clear rise, particularly for AD, throughout the second half of the year, with a higher net balance. The same pattern was observed in both sexes (data not shown).

It can be concluded that during the COVID-19 pandemic, a specific pattern in hospital admissions due to DM complications was observed in Andalusia. Significant reductions in LLA rates in patients with DM were observed, in agreement with data reported in other countries during the first wave of the COVID-19 pandemic.<sup>2</sup> Interestingly, a novel increase in AD was noted once strict lockdown ended, representing an early indicator of the direct and indirect effects of the pandemic on DM complications, which included delays in presentation due to either healthcare or patient factors, changes in individual behaviors that worsened the metabolic control<sup>3</sup> as well as consequences of the SARS-CoV-2 infection itself, which caused acute



**Figure 1** Annual age-adjusted rates (AARs) related to acute and chronic diabetes complications, 2018–2020 (A) and monthly hospital admissions rate related to acute and chronic diabetes complications, 2020 vs 2018/2019 average rate (B). (A) Annual age-adjusted rates (AARs) related to acute and chronic diabetes complications, 2018–2020. Note: The bars in the figure and the parentheses in the table correspond to the 95% confidence intervals. Acute, acute decompensations; CVC, cardiovascular complications; HF, heart failure; LLA, lower limb amputations. (B) Monthly hospital admissions rate related to acute and chronic diabetes complications, 2020 vs 2018/2019 average rate. Note: The yellow shading shows the duration of the lockdown period established by the Spanish Health Authorities between March 15, 2020 and June 21, 2020.

DM illness or causing pancreatic alterations. AD is a preventable condition when early medical and adequate patient training is provided, highlighting the importance of access to healthcare and prompt recognition of new cases, especially among vulnerable patients.

We can hypothesize that the decrease in hospital admissions during lockdown may be due, on one hand, to the *fear* of the population to set foot in emergency rooms or doctors’ offices, and, on the other hand, to an *attention diversion* to COVID-19 pathology throughout the health system. The silver lining of the COVID-19 pandemic should focus on establishing innovative management strategies to treat glycemic decompensations promptly; better control of the risk factors that predispose to the appearance of chronic DM complications; proactive recruitment models for patients undergoing poor disease control and/or follow-up losses; and finally, continuous access to recommended comprehensive diabetes care.<sup>4 5</sup>

**Author affiliations**

- <sup>1</sup>Plan Integral de Diabetes de Andalucía, D.G. de Salud Pública y Ordenación Farmacéutica, Consejería de Salud y Familias, Sevilla, Spain
- <sup>2</sup>Servicio de Endocrinología y Nutrición, Hospital Universitario Virgen Macarena, Sevilla, Spain
- <sup>3</sup>Servicio de Endocrinología y Nutrición, Hospital Regional Universitario de Málaga/ Universidad de Málaga, Instituto de Investigación Biomédica de Málaga. CIBERDEM, CIBER de Diabetes y Enfermedades Metabólicas asociadas, Málaga, Spain
- <sup>4</sup>Servicio de Endocrinología y Nutrición, Hospital Universitario Puerta del Mar, Cádiz, Spain
- <sup>5</sup>Servicio de Bioquímica Clínica, Hospital Universitario Virgen Macarena, Sevilla, Spain

**Acknowledgements** The authors thanks Sofia Perea, Pharm D, PhD, for her support in writing the manuscript.

**Contributors** MAM-B: Conception and design, planning, data analysis and data interpretation. EM: Conduction, reporting, design, planning, data acquisition, data analysis and data interpretation. RR: Design and data interpretation. PRdV: Design and data interpretation. GR-M: Design and data interpretation. GO: Design and data interpretation. MA-D: Design and data interpretation. AL-J: Design and data interpretation.

**Funding** This study has been funded by Instituto de Salud Carlos III through the grant number: PI 17/01674 (co-funded by European Regional Development Fund/ European Social Fund ‘A way to make Europe’/ ‘Investing in your future’) and by the Spanish Diabetes Society and the Spanish Diabetes Society Foundation through XII SED grant for clinical and basic research projects in diabetes led by young researchers (grant number: N/A).

**Competing interests** None declared.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by Ethics Committee: Hospital Universitario Virgen Macarena (Approval ID number: ID 1409-N-20).

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

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

**ORCID iDs**

- Manuel Aguilar-Diosdado <http://orcid.org/0000-0001-9657-5949>
- Maria Asuncion Martinez-Brocca <http://orcid.org/0000-0001-9740-122X>

## REFERENCES

- 1 Valdés S, García-Torres F, Maldonado-Araque C, *et al*. Prevalence of obesity, diabetes and other cardiovascular risk factors in Andalusia (southern Spain). Comparison with national prevalence data. The Di@bet.es study. *Rev Esp Cardiol* 2014;67:442–8.
- 2 Valabhji J, Barron E, Vamos EP, *et al*. Temporal trends in lower-limb major and minor amputation and revascularization procedures in people with diabetes in England during the COVID-19 pandemic. *Diabetes Care* 2021;44:e133–5.
- 3 Ruiz-Roso MB, Knott-Torcal C, Matilla-Escalante DC, *et al*. COVID-19 Lockdown and changes of the dietary pattern and physical activity habits in a cohort of patients with type 2 diabetes mellitus. *Nutrients* 2020;12:2327.
- 4 Beaney T, Clarke JM, Jain V, *et al*. Excess mortality: the gold standard in measuring the impact of COVID-19 worldwide? *J R Soc Med* 2020;113:329–34.
- 5 Beran D, Aebischer Perone S, Castellsague Perolini M, *et al*. Beyond the virus: ensuring continuity of care for people with diabetes during COVID-19. *Prim Care Diabetes* 2021;15:16–17.