

Plan for Hypertensive Disorders in the Puerperium Period: Zero Vascular and Renal Risk

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BACKGROUND

Hypertensive disorders of pregnancy (HDP) are associated with an increased postpartum risk of cardiovascular disease or kidney failure. In recent years, the profile of pregnant women has changed. Factors such as older age at pregnancy, obesity, diabetes, chronic hypertension, and chronic kidney disease, and the use of assisted reproductive technologies, have become more common. These changes

have contributed to a rise in HDP cases, with the WHO estimating an incidence of 2–10% globally.^{1–8}

However, there is scarce information on current practice regarding follow-up of HDP in diverse healthcare systems, especially in an evolving demographic environment. Spain is one of the Western European countries that does not yet have a national HDP registry.

Recognising this gap, a multidisciplinary group of Spanish healthcare professionals, including nephrologists, primary care physicians, and obstetricians, has proposed a national postpartum care plan. This plan will focus on vascular and kidney health, aiming to improve prevention, health promotion, and long-term monitoring for affected women.

This study⁹ aimed to analyse, for the first time, the incidence and trends of HDP in Spain between 2016–2022. It also sought to identify regional differences in HDP rates across the country.

METHODS

Researchers used data from the Spanish Ministry of Health's Registry of Specialized Care Activity (RAE-CMBD). HDP cases were identified using international statistical classification of disease (ICD) codes (ICD-9 and ICD-10): pre-existing hypertension complicating pregnancy, childbirth, and the puerperium (O10); chronic hypertension with superimposed preeclampsia (O11); gestational (pregnancy-induced) oedema and proteinuria without hypertension (O12); and gestational hypertension (O13).

Incidence was calculated by dividing the number of HDP cases by the total number of births and multiplying by 100. To assess trends over time, the incidence in each year was compared to that in 2016. Relative risk (RR) and 95% CIs were used to determine statistical significance. Regional

differences were analysed using Poisson regression models, and adjustments were made for multiple comparisons using the Benjamini-Hochberg method. If the p value for the interaction was <0.05, the temporal evolution differed between the two regions being compared.

RESULTS

The study found a significant increase in HDP incidence in Spain in 2021 (1.80 versus 1.84; RR: 1.055; 95% CI: 1.033–1.076) and 2022 (1.80 versus 1.90; RR: 1.063; 95% CI: 1.041–1.084), compared to 2016 (Table 1). The regions with the highest rates between 2016–2022 included the Balearic Islands, Canary Islands, Melilla, Aragón, Catalonia, and Ceuta (Figure 1).

Importantly, there were significant differences in HDP incidence across Spain's regions, suggesting inconsistencies in diagnosis or reporting practices (Table 2). While Spain's overall HDP incidence

(1.8%) is lower than that of other European countries like France (2.3%), Greece (2.2%), and Norway (4.0%), this may reflect underdiagnosis or gaps in follow-up care.^{10,11}

CONCLUSION

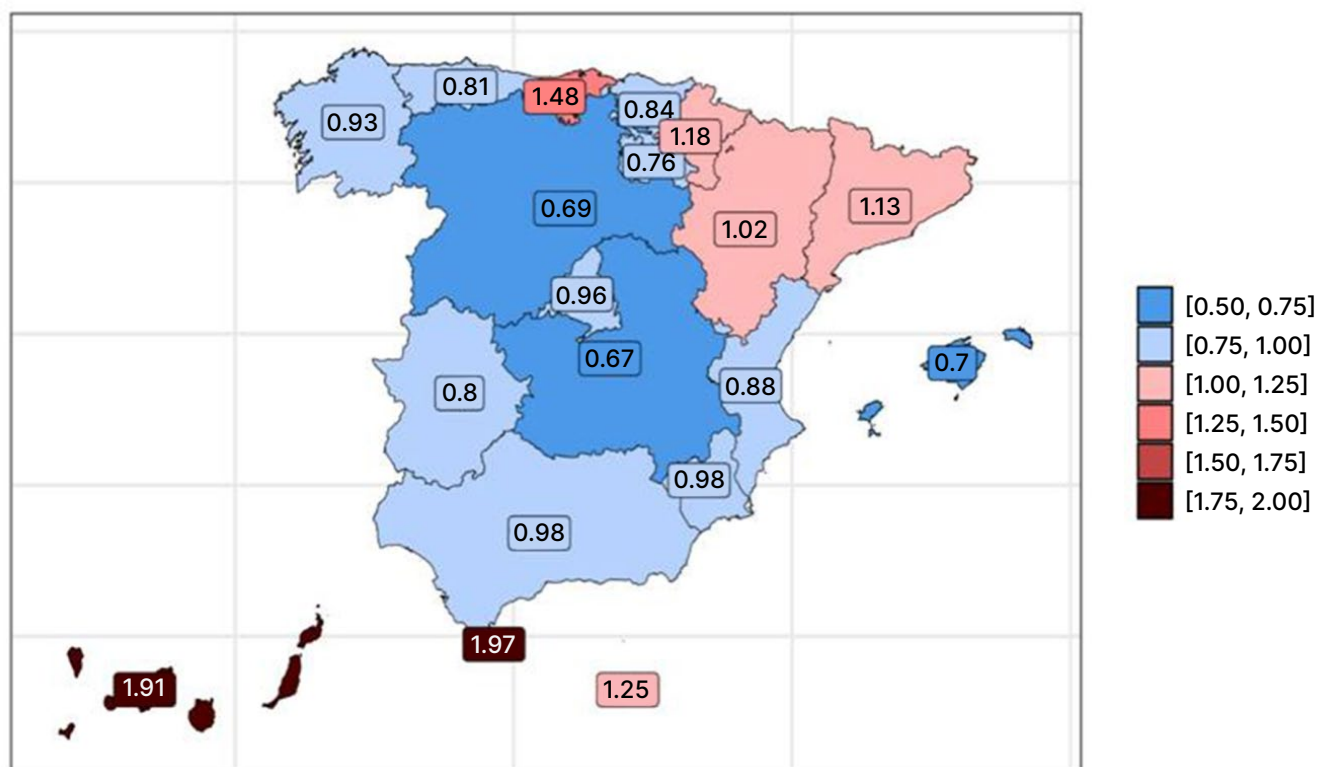
This is the first nationwide study to examine HDP incidence in Spain and its regional variations. A significant increase in incidence was observed over time in Spain from 2016–2022. Most regions in Spain reported an incidence below 1. The relatively low incidence suggests that many cases may go undiagnosed, potentially putting women at risk for future cardiovascular complications. The significant difference in incidence variability between the different regions in Spain points out the need for a homogeneous discharge and hospitalisation follow-up protocol for primary care. A national registry and coordinated follow-up system could help ensure better outcomes for mothers and their children.

Table 1: Incidence of hypertensive disorders of pregnancy according to between 2016–2022.

Year	Cases (n)	Births (n)	Population (n)	Incidence	Incident Rate (%)	95% CI
2016	18,126	1,006,168	10,397,739	1.80	1	-
2017	19,822	1,154,944	10,281,335	1.72	0.953	0.934–0.972
2018	18,809	1,050,159	10,211,905	1.79	0.994	0.974–1.015
2019	19,278	1,053,269	10,187,902	1.83	1.016	0.996–1.037
2020	18,441	1,003,902	10,203,555	1.84	1.020	0.999–1.041
2021	19,133	1,007,050	10,140,582	1.90	1.055	1.033–1.076
2022	19,201	1,003,057	10,057,287	1.91	1.063	1.041–1.084

Bold font means the comparison is significant, where 0.953 is a significantly lower incidence, and both 1.055 and 1.063 are significantly higher incidences.

Figure 1: Incidence rate of hypertensive disorders of pregnancy during 2016–2022 in the different regions of Spain.



Color-coded map illustrating incidence rates, with blue representing regions of lower incidence and red indicating areas of higher incidence. The gradient reflects the range of incidence values observed across the dataset.

Table 2: Comparison of temporal trends across Spanish regions.

	Andalucía	Aragón	Canarias	Cantabria	Castilla La Mancha	Castilla y León	Cataluña	Ceuta
Andalucía	-	-	-	-	-	-	-	-
Aragón	0.003	-	-	-	-	-	-	-
Canarias	<0.001	<0.001	-	-	-	-	-	-
Cantabria	<0.001	0.014	<0.001	-	-	-	-	-
Castilla La Mancha	0.004	<0.001	<0.001	<0.001	-	-	-	-
Castilla y León	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Cataluña	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Ceuta	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Madrid	0.026	0.056	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Comunidad Valenciana	<0.001	0.055	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Extremadura	0.001	0.107	0.552	<0.001	0.016	<0.001	<0.001	<0.001
Galicia	0.033	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Islas Baleares	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
La Rioja	0.013	<0.001	<0.001	0.033	<0.001	<0.001	<0.001	<0.001
Melilla	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.003
Murcia	0.007	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Navarra	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.142	<0.001
Pais Vasco	<0.001	0.461	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
Asturias	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 2: Comparison of temporal trends across Spanish regions. Continued.

	Madrid	Comunidad Valenciana	Extremadura	Galicia	Islas Baleares	La Rioja	Melilla
Andalucia	-	-	-	-	-	-	-
Aragon	-	-	-	-	-	-	-
Canarias	-	-	-	-	-	-	-
Cantabria	-	-	-	-	-	-	-
Castilla La Mancha	-	-	-	-	-	-	-
Castilla y Leon	-	-	-	-	-	-	-
Cataluña	-	-	-	-	-	-	-
Ceuta	-	-	-	-	-	-	-
Madrid	-	-	-	-	-	-	-
Comunidad Valenciana	0.082	-	-	-	-	-	-
Extremadura	0.048	0.043	-	-	-	-	-
Galicia	<0.001	<0.001	<0.001	-	-	-	-
Islas Baleares	<0.001	<0.001	<0.001	<0.001	-	-	-
La Rioja	0.003	<0.001	<0.001	0.010	<0.001	-	-
Melilla	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	-
Murcia	<0.001	<0.001	<0.001	0.014	<0.001	0.284	<0.001
Navarra	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pais Vasco	<0.001	<0.001	0.184	<0.001	<0.001	<0.001	<0.001
Asturias	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 2: Comparison of temporal trends across Spanish regions. Continued.

	Murcia	Navarra	Pais Vasco	Asturias
Andalucia	-	-	-	-
Aragon	-	-	-	-
Canarias	-	-	-	-
Cantabria	-	-	-	-
Castilla La Mancha	-	-	-	-
Castilla y Leon	-	-	-	-
Cataluña	-	-	-	-
Ceuta	-	-	-	-
Madrid	-	-	-	-
Comunidad Valenciana	-	-	-	-
Extremadura	-	-	-	-
Galicia	-	-	-	-
Islas Baleares	-	-	-	-
La Rioja	-	-	-	-
Melilla	-	-	-	-
Murcia	-	-	-	-
Navarra	<0.001	-	-	-
Pais Vasco	<0.001	<0.001	-	-
Asturias	<0.001	0.006	<0.001	-

Poisson regression models applied to analyse the temporal evolution in different regions. The models include an interaction term between time and Spanish region, allowing for the assessment of differences in temporal trends across regions.

References

- Bell MJ. A historical overview of preeclampsia-eclampsia. *J Obstet Gynecol Neonatal Nurs*. 2010;39(5):510-8.
- Rana S et al. Angiogenic factors and the risk of adverse outcomes in women with suspected preeclampsia. *Circulation*. 2012;125(7):911-9.
- Chappell LC et al. Diagnostic accuracy of placental growth factor in women with suspected preeclampsia: a prospective multicenter study. *Circulation*. 2013;128(19):2121-31.
- Zeisler H et al. Predictive value of the sFlt-1:PIGF ratio in women with suspected preeclampsia. *N Engl J Med*. 2016;374(1):13-22.
- ACOG Committee on Obstetric Practice. ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. American College of Obstetricians and Gynecologists. *Int J Gynaecol Obstet*. 2002;77(1):67-75.
- Kedziora SM et al. Kidney injury caused by preeclamptic pregnancy recovers postpartum in a transgenic rat model. *Int J Mol Sci*. 2021;22(7):3762.
- Butler MJ et al. The pathological relevance of increased endothelial glycocalyx permeability. *Am J Pathol*. 2020;190(4):742-51.
- Vikse BE et al. Preeclampsia and the risk of end-stage renal disease. *N Engl J Med*. 2008;359(8):800-9.
- Gracia-Iguacel C et al. Spanish plan for hypertensive disorders in the puerperium: zero vascular and renal risk. Abstract 1002. ERA Congress, 4-7 June, 2025.
- Abalos E et al. Global and regional estimates of preeclampsia and eclampsia: a systematic review. *Eur J Obstet Gynecol Reprod Biol*. 2013;170(1):1-7.
- Gracia-Iguacel C et al. Increasing incidence of hypertensive disorders of pregnancy and association with decreased GFR and albuminuria: The need for post-partum follow-up. *Placenta*. 2025;165:42-9.