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EURODOPPS

DIALYSIS OUTCOMES AND PRACTICE PATTERNS STUDY

GEOGRAPHICAL AND CLIMATIC VARIATIONS OF BLOOD PRESSURE IN HEMODIALYSIS PATIENTS

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INTRODUCTION AND AIMS

Seasons and climate have been shown to influence the regulation of blood pressure (BP).[1] It is not known however if this phenomenon varies across countries with different climates. Our aim was to estimate BP seasonality in different locations and to test the influence of climatic parameters in hemodialysis (HD) patients.

METHODS

This is a posterior analysis of the DOPPS study phases 3-4 (2005-2011), which included random samples of adult HD patients from 7 European countries: Spain, Italy, France, Belgium, Germany, United Kingdom, Sweden (**figure 1**).

HD facilities were matched to weather stations by distance. Monthly climatic observations during follow-up were obtained from national and international databases.

Changes in pre-dialysis (preHD) and post-dialysis (postHD) systolic (SBP) and diastolic BP (DBP) were analyzed by mixed models with location (country or latitude), seasonality (season or climate) and their interaction as exposures.

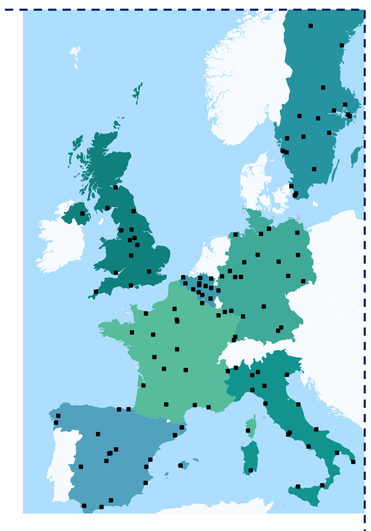

Figure 1. Spatial distribution of HD facilities across 7 European countries

RESULTS

CROSS-SECTIONAL ASSOCIATION WITH LOCATION

The study included 9655 patients on hemodialysis for minimum 6 months from 263 facilities, and over 50 000 observations (**table 1**).

In Northern places, BP was significantly higher across the 7 countries (**table 1**).

For a 10-degree increase in latitude (1111km to the North), the mean and 95% confidence interval for change in preHD and postHD SBP were 5.1 [3.7 ; 6.4] mmHg and 4.4 [2.9 ; 5.9] mmHg.

PreHD and postHD DBP changed of 1.7 [0.8 ; 2.6] and 1.0 [0.2 ; 1.9] mmHg for the same increase in latitude.

Table 1. Patients characteristics at baseline

Country	Spain	Italy	France	Belgium	Germany	United Kingdom	Sweden
Number of patients (n)	1571	1384	1401	1246	1556	1144	1353
Age (year)	64 ± 16	66 ± 14	65 ± 15	69 ± 14	65 ± 14	62 ± 16	65 ± 14
Gender (% Male)	59%	59%	58%	57%	59%	58%	65%
BMI (kg/m²)	25.2 ± 4.5	24.8 ± 5.1	25.3 ± 5.6	25.7 ± 5.1	26.5 ± 5.2	26.3 ± 5.4	25.9 ± 6.0
Hypertension (% yes)	86%	74%	87%	82%	92%	70%	84%
Diabetes (% yes)	31%	28%	35%	38%	40%	28%	41%
Renal disease (%)							
Diabetes (I or II)	19%	17%	23%	24%	27%	16%	26%
Glomerulonephritis	13%	14%	13%	9%	15%	12%	13%
Hypertension	11%	15%	15%	14%	16%	8%	17%
Other/Uncertain	57%	54%	49%	53%	42%	64%	44%
Dialysis duration (hr/week)	12.0 ± 2.3	11.5 ± 1.8	12.0 ± 1.9	12.0 ± 2.0	13.3 ± 2.3	11.3 ± 1.7	13.0 ± 2.4
Intradialytic weight loss (% postHD weight)	3.1 ± 1.4	3.7 ± 1.5	3.4 ± 1.5	2.7 ± 1.5	2.6 ± 1.6	2.4 ± 1.3	2.7 ± 1.5
Blood pressure (mmHg)							
PreHD SBP	133 ± 23	134 ± 23	139 ± 25	139 ± 24	133 ± 21	143 ± 25	140 ± 26
PreHD DBP	71 ± 13	72 ± 13	72 ± 15	71 ± 14	72 ± 12	74 ± 15	74 ± 14
PostHD SBP	126 ± 23	129 ± 24	132 ± 25	132 ± 23	127 ± 21	132 ± 25	135 ± 27
PostHD DBP	69 ± 13	71 ± 13	70 ± 15	69 ± 13	70 ± 11	69 ± 14	72 ± 14

Data summarized as percentage or mean ± standard deviation.

LONGITUDINAL ASSOCIATION WITH CLIMATE

Patients were evaluated every four months up to 4 years (median and interquartile range: 1.3 (0.7 ; 2.3) years)). PreHD SBP was lower in summer and higher in winter (change: 1.8 [1.3 ; 2.3] mmHg), with greater changes in the South ($P_{interaction}$ = 0.04), **table 2**.

PreHD SBP was associated with climate (**table 2**). The greatest effects were observed for outdoor temperature, which was associated with lower BP, with steeper slopes in more Southern places ($P_{interaction}$ = 0.005, **table 2**).

Results were similar for preHD DBP. In contrast, postHD SBP and DBP did not vary with climate.

Table 2. Effect of climate on preHD SBP level.

Climate exposure (Unit of change)	Effect of Climate at a latitude of 50° (mmHg)		Effect of Climate × Latitude (mmHg)	
	Estimate and 95% CI	P-value	Estimate and 95% CI	P-value
Seasons ($\Delta_{Win-Sum}$)	1.8 [1.3 ; 2.3]	< 0.001	-0.8 [-1.7 ; -0.01]	0.04
Mean outdoor temperature (7.2°C)	-0.8 [-1.0 ; -0.5]	< 0.001	0.4 [0.1 ; 0.8]	0.005
Cumulative sunshine duration (89 h)	-0.6 [-0.8 ; -0.3]	< 0.001	-	-
Maximal wind speed (5 km/h)	-0.02 [-0.5 ; 0.4]	0.09	-0.9 [-1.5 ; -0.2]	0.008
Cumulative rainfall (56 mm)	-0.1 [-0.3 ; 0.2]	0.5	-0.4 [-0.7 ; -0.04]	0.03
Mean humidity (10.7%)	0.4 [0.04 ; 0.7]	0.03	-	-
Mean atmospheric pressure (4.8 hPa)	0.1 [-0.2 ; 0.4]	0.3	-	-

Each line represent distinct models. All models were adjusted for latitude.

Conclusions

There is a geographical gradient of BP and BP seasonality in HD patients in Europe. In southern places, BP level is lower and displays greater seasonal changes. There is a need to consider these effects when evaluating and treating BP in this population and potentially in others.

Acknowledgements

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Clinical hypertension

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