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## Introduction

- Recent research in international hemodialysis (HD) databases showed evidence for seasonality of hemodynamic parameters [1].
- In addition to seasonal trends increased awareness of the importance reducing dialysate to serum sodium gradients in the dialysis prescription and an emphasis on dietary sodium restriction may have resulted in effects on secular trends in recent years.
- Here we investigate secular and seasonal continuous-time trends of hemodynamic parameters in a large US HD population.

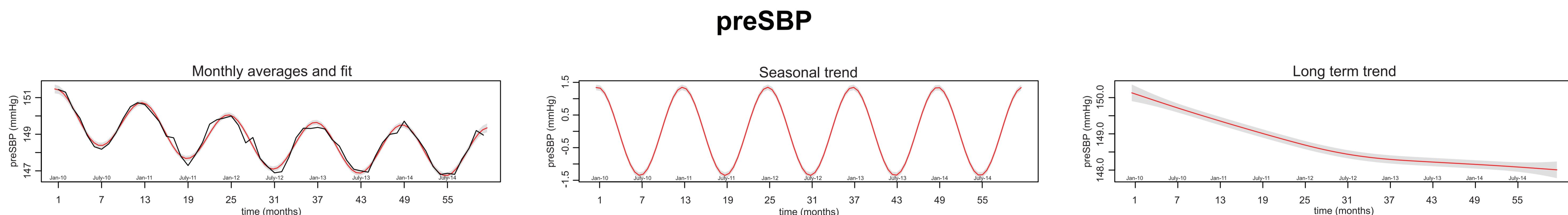
## Methods

- All patients receiving HD in Fresenius Medical Care North America (FMCNA) clinics from 1/2010 to 12/2014 were included in the analysis.
- We assume that the response variable (e.g. systolic blood pressure, SBP) is a composite of secular and seasonal trends and random errors. The seasonal and long-term trends were estimated using partial spline models [2]. We treat calendar time as a continuous variable while time in respect to season was treated as discrete variable (i.e. four seasons) as in [1].

## Results

- 354,572 patients receiving HD in FMC NA clinics were studied over a period of 5 years.
- The upper panel shows the data (black line) and overall fit (red line). The middle and bottom panels indicate seasonal and secular trends. Shaded areas are 95% confidence intervals.
- The analysis clearly indicates that predialysis systolic BP (preSBP; **Figure 1**) and diastolic BP (preDBP) are highest in winter and lowest in summer. A decreasing long term trend of preSBP and preDBP 2010 to 2012 was followed by a more stable evolution. Blood pressure trends were comparable in incident (not shown) and prevalent HD patients.

**Figure 1** Monthly average and overall fit, seasonal trend and the long-term trend of preSBP



## Conclusions

- PreSBP and preDBP show a strong seasonal component in both incident and prevalent HD patients.
- We hypothesize that seasonal trends in interdialytic weight gain, inflammatory and other diseases status, ambient temperature, UV light exposure, and vitamin D levels are potential mediators.
- The secular decline in blood pressure may be related to lower dialysate sodium levels, improved antihypertensive therapies, increased awareness of the importance of dietary sodium restriction and lower ESA dosing.

## References

1. Seasonal variations in mortality and clinical indicators in international hemodialysis populations from the MONDO registry, Guinsburg et al. BMC Nephrology (2015) 16:139
2. Wang (2011). Smoothing Splines: Methods and Applications Chapman & Hall

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