**Blood Pressures are Going Down World-Wide -**

**But why?**

1Julia A. Critchley and 2Richard S. Cooper

1 Public Health Research Institute

St George’s University

London SW 17 0RE

[jcritchl@sgul.ac.uk](mailto:jcritchl@sgul.ac.uk)

(Corresponding author)

2 Department of Public Health Sciences

Loyola University Medical School

2160 S. First Ave

Maywood, IL 60153

[rcooper@luc.edu](mailto:rcooper@luc.edu)

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Large epidemiological pooling studies, such as the NCD Risk Factor Collaboration1, have provided important findings on trends in health and disease through their on-going efforts at pooling population surveys and other health metrics. The key aim of this study2 is to tease out whether it is the mean population blood pressure (BP) that has declined (suggesting a population effect on blood pressure e.g. through changes in diet, early life course experiences or other factors) or truncation of the “right tail” of the blood pressure distribution (which would indicate an effect of anti-hypertensive treatment among those with significantly raised BP levels). Overall the global decline appears to be mostly due to a fall in mean BP, although there is an important contribution from anti-hypertensive treatment. On occasions, there has been polarization in debates assessing the importance of population versus “high risk” approaches in cardiovascular epidemiology 3, and we welcome an analysis that attempts to consider the impact of both simultaneously. This paper suggests that just over half of the decline in hypertension can be attributed to downward trends in entire BP distributions, and with a possibly greater contribution from treatment in high-income areas2.

Whilst not the key aim of this paper, the “good news” is the finding of a broad downward trend in BP globally, occurring in most population and age-sex groups, with very substantial falls in some high-income countries2. This global downward trend may seem surprising, given that one of the key determinants of BP at an individual level (i.e. body mass index - BMI) has been increasing in virtually every population over the last few decades4. Some studies have suggested a weakening over time of the association between body size and BP 5,6. The explanations for this are unclear but may include changes in other dietary factors (particularly alcohol, and sodium / potassium intakes, though it is less clear how changes in these factors affect the BMI-BP relationship7). It is also difficult to be confident of an overall decline in sodium intake in the latter half of the 20th century since calorie intake, driven by body size, has obviously risen steadily. Improvements in early life course experiences (suggested by rising birth weight), and higher use of anti-hypertensives may also alter BMI-BP associations. Alternatively, if lean body mass is changing over time, as well as fat mass, BMI may be becoming a poor marker of adiposity, though a recent systematic review did not show a stronger association between waist circumference and risk of hypertension8. Whatever the physiology, rising BMI’s should still push population BP’s upward. Further research is required to understand associations between adiposity, hypertension, and the modulating effect of treatment.

Another partial explanation for the global downward trends in BP is likely to be changes in measurement technique. Better sampling technique, training of personnel, and a structured exam with multiple measurements, along with use of electronic devices has greatly improved the precision of BP surveys in the last 50 years. As is well recognized, BP declines with multiple readings at the same visit and with repeat visits on subsequent days9. Most population studies before the 1990’s did not take 3 readings, and then only use the mean of the last 2, as is current practice, and they also showed evidence of marked digit preference (more readings ending in zero than would be expected). Further, use of inappropriate cuff sizes among the obese could have over-estimated blood pressure in some earlier surveys10. These limitations in methodology were almost always correlated with higher mean BP’s; the overall improvement in methods can therefore have been expected to have led to downward shifts in apparent population prevalence of hypertension, as was noted in the US between the NHANES I and NHANES III reports11. Some adjustments were made for changes in measurement devices in the analysis published, but this may only be one factor introducing measurement error. It is worth noting, however, that the continuous decline in stroke mortality, starting with the earliest period of vital records around 1900, strongly suggest that BP’s have indeed been falling over the modern era. Although appropriate data are not available, refrigeration and other methods of processing foods have eliminated the need for curing of meat and fish, and may have been a factor in the BP in the first half of the 20th century;: the success of BP treatment campaigns accelerated this decline after 197012.

Whilst the global picture set by this publication seems plausible, some of the regional results seem surprising, and could result from a relative lack of high quality original data, and therefore must be viewed with considerable caution. A key drawback of any analysis with this number of studies and data is the difficulty in finding a simple way to present any quality assessment or sense of the strength of the datasets available. Without detailed knowledge of measurement protocols in relation to a given data set it is difficult to offer an interpretation or make sense of outlying values. Another problem interpreting trends in any key risk factor over many decades could be changes in response rates (generally declining globally), not always well reported, and the selection biases this could introduce. We therefore cannot exclude the possibility that recent favourable trends in BP presented here may be somewhat exaggerated. Data pooling projects include studies with very heterogeneous study designs, sampling frames and methods of measurement, and could be over-turned by better primary data in some areas. These estimates should therefore not preclude or detract from dedicated studies that attempt to measure secular trends in population BP globally, especially in regions where high quality data is currently most sparse.

Above all, this study highlights the importance of strengthening population approaches to BP lowering. They also underscore the compelling need for high quality research to monitor BP trends with the intent to find out why downward trends are taking place; we need much better surveillance and intervention tools if we are to ultimately eliminate this public health scourge. In this paper, high income regions with the greatest decrease in hypertension prevalence also showed the biggest decline in mean BP. Countries such as the UK implemented a much lauded “salt campaign” in the early 2000s, based on targeting consumers with educational campaigns, and better labelling of foods, but also engaging the food industry in voluntary agreements to reformulate some processed foods, such as tinned soups and bread. This is thought to have led to significant reductions of approximately 0.175g daily per year from 2003-0713, though intakes remain above target levels. A stronger intervention, encompassing taxation or legislation, may have had a greater effect14. Evidence-based population strategies to reduce blood pressure through prevention of obesity and reductions in sodium or alcohol intakes should be strengthened, alongside treatment of hypertension in primary care settings.

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