

The Case of Lighting CMFs in HSM Applications

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Ida van Schalkwyk, Ph.D., Safety, Policy, and Innovations Engineer
Development Division, Washington State DOT

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Main points

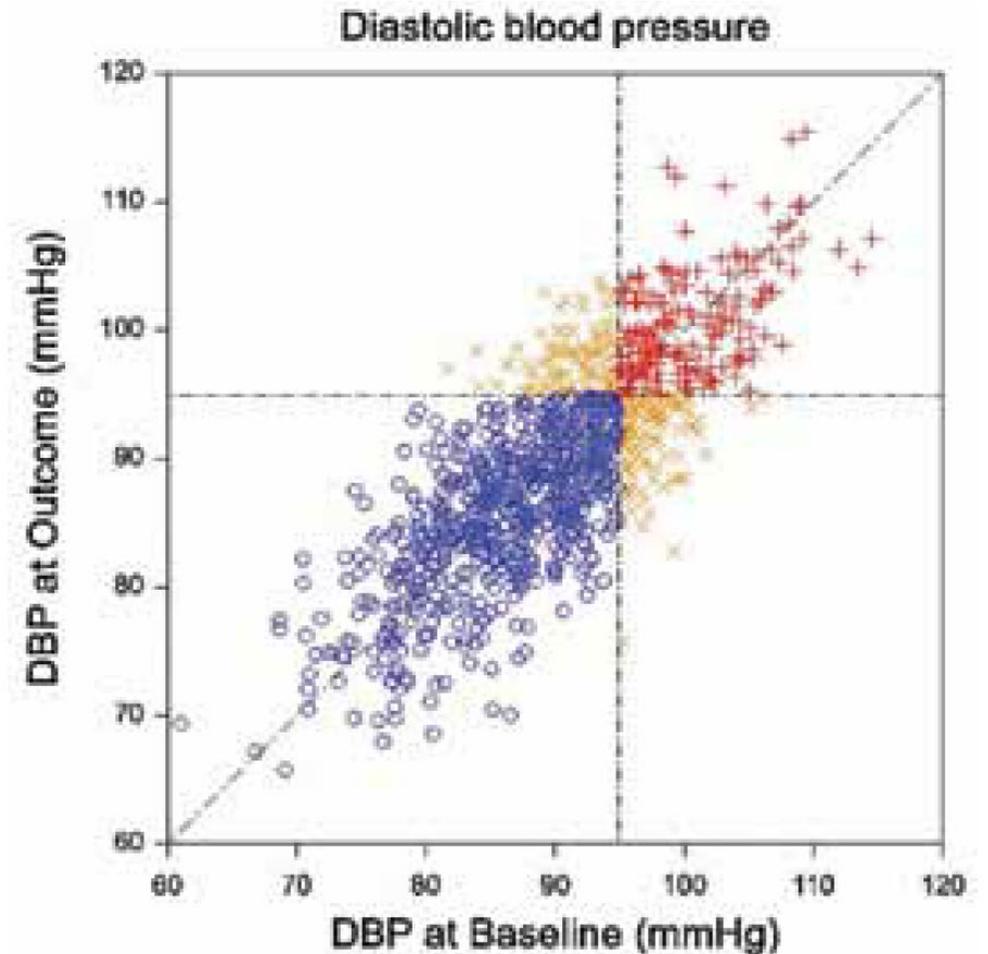
- Methods are evolving
- A mindset
- Knowledge evolves
- Conclusion

Evaluation methods are evolving

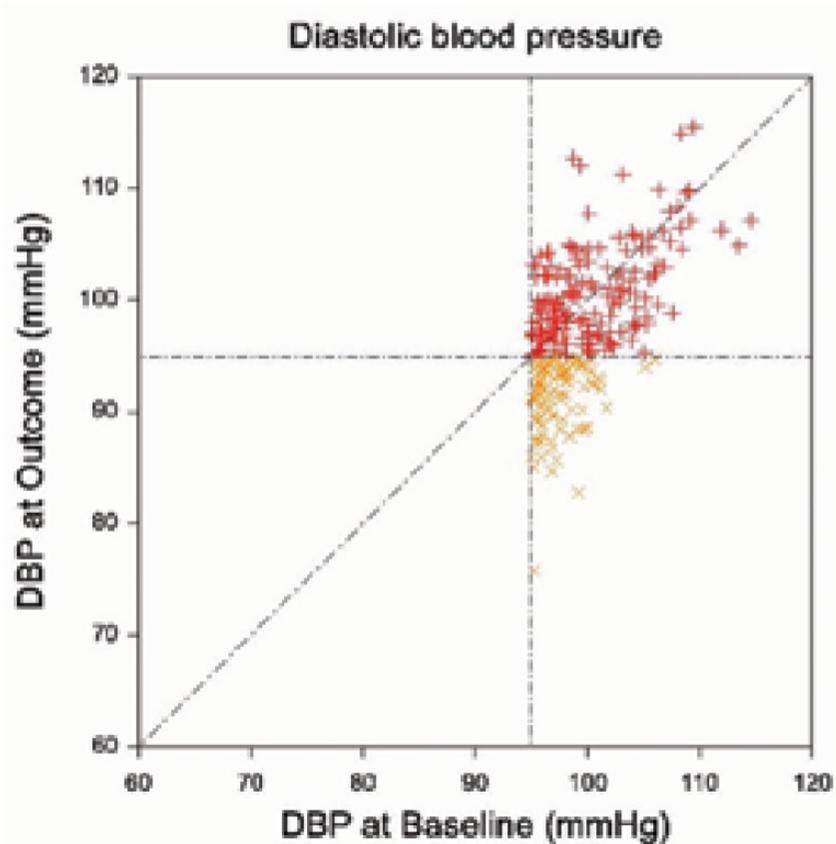
Let's talk blood pressure

“1000 individuals had their diastolic blood pressure (DBP) measured on two occasions: at ‘baseline’, X, and at ‘outcome’, Y”

“An arbitrary but common cut off of 95 mmHg is taken as being the boundary for hypertension. Individuals are labelled as being of one of three sorts: hypertensive at both baseline and outcome (labelled with a red +), normotensive at both baseline and outcome (labelled with a blue 0) and hypertensive on one occasion and not the other (labelled with an orange x).”



Senn, S, 2009. Three things that every medical writer should know about statistics, The Write Stuff, Vol. 18, No.3, pp.159-162, The Journal of the European Medical Writers Association.



Who would be picked for the medical trail ?

... the hypertensive patients

Blood pressure medication

Figure 1 Simulated results at baseline and outcome for diastolic blood pressure (mmHg) for 1000 individuals in a population.

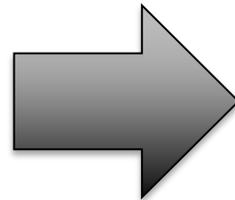
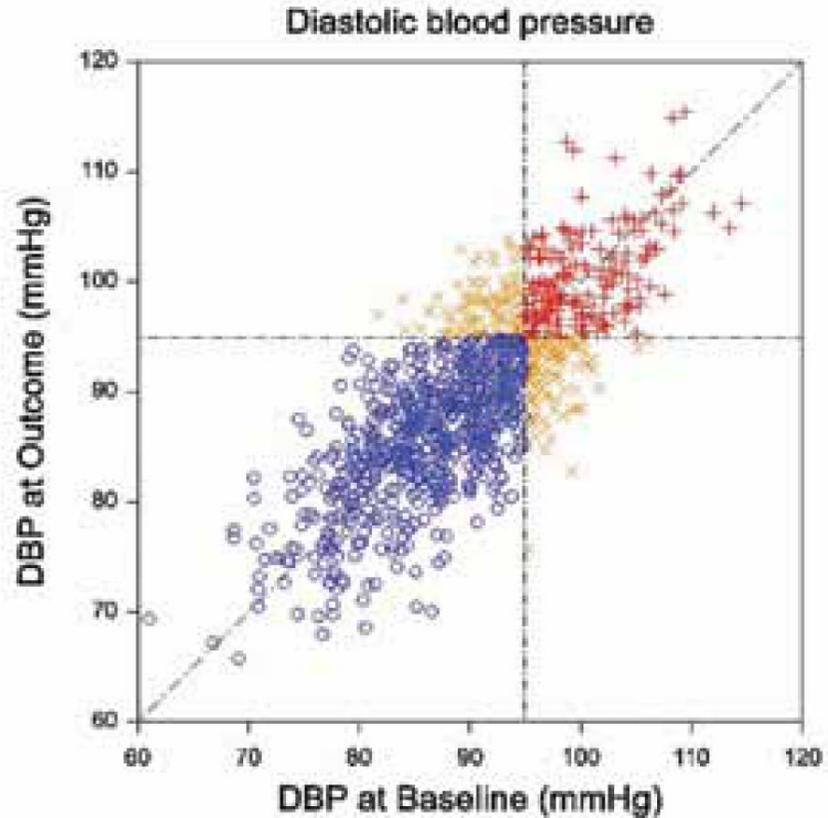
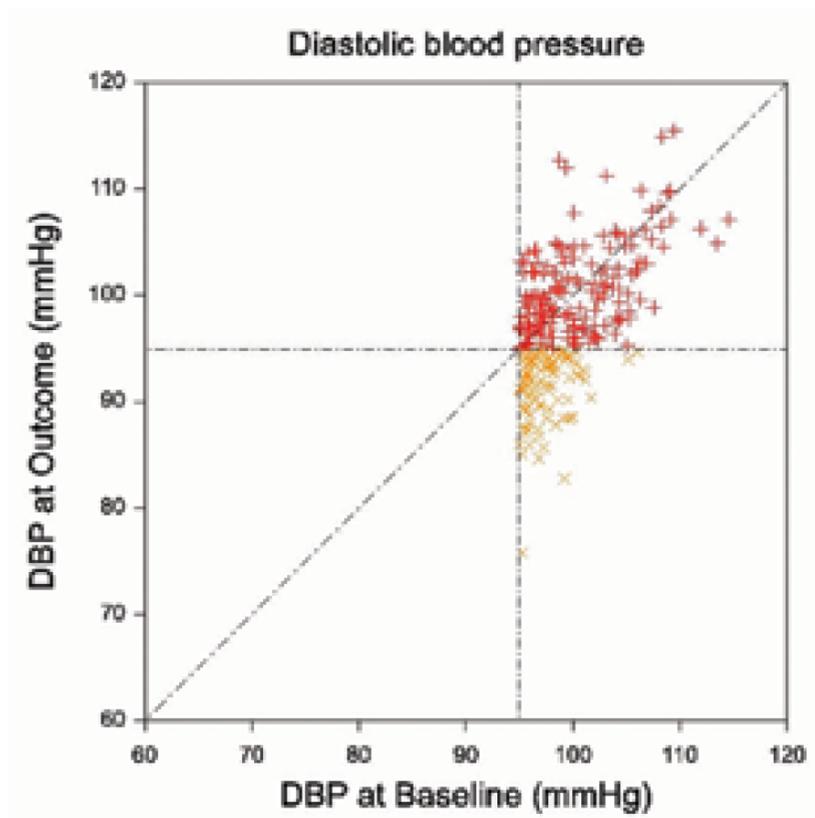


Figure 3 Simulated results at baseline and outcome for diastolic blood pressure (mmHg) for 1000 individuals in a population with those who are normotensive at baseline removed.



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Blood pressure medication

“The consequence is that on average patients will appear to improve even if the treatment is ineffective. In fact, patients given placebo can be expected to improve for reasons that are purely statistical.” (emphasis added)

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How's your
partner?



Compared to
what?

medical
statistician

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The Journal of the European Medical Writers Association.

A mindset

How we think about 'how the world works' or 'what is true'

“sometimes even scientists will say that something or other has been scientifically proven. But I hope that you understand that **science never proves anything definitively forever.** Hopefully science remains curious enough to look for and humble enough to recognize when we have found the next outlier, the next exception, which... teaches us what we don't actually know”

Kevin B. Jones, Cancer researcher

https://www.ted.com/talks/kevin_b_jones_why_curiosity_is_the_key_to_science_and_medicine

Emphasis added.



WSDOT assessing the lighting CMF in the HSM1 & beyond

CMFs for lighting in HSM1

- Elvik 1996 (referenced in HSM1 as Elvik and Vaa 2004)
 - Meta analysis of 37 studies
 - Focus: adding lighting where the location was previously unlit.
 - The studies were published between 1948 and 1989.
 - Methods: crash rates, daytime-nighttime crash rate ratios
 - “as far as statistical techniques for data analysis are concerned, most studies have relied on quite simple techniques, like estimating an odds ratio and testing it for statistical significance. More advanced multivariate analyses, in which the choice of statistical techniques is more important, are not found in this area” (Elvik 1996) (emphasis added).
 - In 81 percent of the cases the authors concluded that lighting improves safety performance and **in 19 percent of the cases the authors found that “safety has deteriorated”**.

Lighting CMFs in HSM1

- Elvik 1996 (referenced as Elvik and Vaa 2004)
 - Studies quantified the impact of the addition of lighting:

$$\text{Ratio} = \frac{\text{Nighttime crashes before (unlit)} / \text{Nighttime crashes after (lit)}}{\text{Daytime crashes before (unlit)} / \text{Daytime crashes after (lit)}}$$

- Use of daytime crashes questionable: shifts in crash types, impairment prevalence, etc.
- Studies did not account for contextual differences
 - “*the safety effect of public lighting is **likely to vary substantially** from one case to another, depending, inter alia, on luminance levels, **traffic environment and predominant type of accident at the location**” – Elvik (1996) (emphasis added)*
- Harkey et al 2008 quality ratings
 - Intersection lighting: low
 - Segment lighting: medium-low

Research for HSM2

- NCHRP 17-58 project for 6+ lane urban arterials & one way roads
 - Found no correlation with lighting

Knowledge evolves

The evolution of our thinking about safety performance

- Effects are not just ‘bad’ or ‘good’: it becomes ‘it depends’
 - The context: the effect may not be fixed: may vary
 - The target crash type and/or severity
 - The extent to which we collect data about the feature we’re asking questions about will limit to which extent we can advance our understanding of safety performance & the feature
 - (if we don’t collect and maintain enterprise datasets on our bicycle lanes or pedestrian crosswalks or signal settings then these can’t be studied as easily => high research cost & likely only a subset of types/contexts/ application environments)

The counterintuitive discussion

We have a finding that is contrary to what represents ‘a deeply held belief’ or ‘results from a naïve before-after study/studies’

- Is this true?
- Must be wrong
- There is ulterior motive

OR do we say:

- With any study, remain curious about what was done, assumptions made, methods used, etc.
 - It is nothing personal (compared to: so and so were on the team we must trust the results, “vision of the anointed”)
 - Even if it is consistent with what we think we know → it warrants investigation, further review, and a check: not just if it differs

How are we encouraging use of different methods; publishing and discussion of results; and opening discussion to views that:

- are different from ours
- contrary to what some specific person/ trusted entity says
- not as beneficial as our leadership promised it will be (or what we promised when we sold the idea to our leadership)?

Reminding ourselves

“The work you do is important. In other jobs their mistakes usually don’t matter much, but when ***you*** make a mistake, people can die or get seriously hurt”

- Charlize, 9-yr old (2018)



Questions?