SMDM 2024 Oral Presentation – Script

Today I will be sharing research that our team has been conducting on how different ways of framing hypertension information affect perceptions of risk as well as intended responses.

Very briefly - I have no perceived or actual conflicts of interest to disclose

To begin – I would like to acknowledge our collaborators, at the University of Missouri and Oregon Health and Science University. In addition, we thank the Agency for Healthcare Research and Quality for supporting our work.

Hypertension is considered one of leading factors for cardiovascular disease, and premature death as a whole, WORLDWIDE!

As many as 45% of US adults have hypertension, and an estimated 86% of hypertension globally is uncontrolled.

Yet we also have a wide array of cheap and effective drugs for managing hypertension.

So if we have good drugs, that are cheap and work, why do we have so much global uncontrolled hypertension?

Kerr and colleagues created a clinical action model describing factors contributing to undertreated hypertension, and one of the factors is clinical uncertainty.

This can be as simple as “I can’t tell if my patient has elevated blood pressure” - elements of clinical uncertainty can manifest itself in electronic medical records.

For example, this is how University of Missouri Hospitals used to display blood pressure in 2020. Systolic blood pressure is in the topic section, and diastolic blood pressure is in the bottom section. The two red dotted lines bracket a generally ‘normal’ blood pressure range.  
  
Notably, both measures of blood pressure are often both inside AND outside the acceptable range. In practice, this leads to clinicians being uncertain if the patient’s blood pressure is truly elevated.

Our recent prior research worked to address these issues – we used a rapid prototyping process that started with our original chart from the electronic health record, which we refined into this chart here by using a ‘smoothing function’. This graph improved risk comprehension, except for subjects with weaker numeracy skills. The next step in rapid prototyping was seeing if additional graphics would help patients ‘get it’.

We tested several forms of risk communication, comparing a verbal summary (with plain language about being at or above the target goal), a simpler three category stoplight display, and a gradient that indicates relative risk categories continuously.

The stoplight display resulted in the most well-calibrated risk perception, as the gradient had lower perceptions of control, which could lead to unnecessary worry in patients. Usage of this ‘stoplight’ graphic was integrated into our work moving forward.

Moving to our current work – we wanted to extend what we had done previously in new directions

We wanted to look at the effects of social comparison on risk perception and behavior.

It is well known that social comparison affects how people perceive risk and their intentions to act – Individuals react strongly when told they have risk levels above average.

For example, this breast cancer decision tool designed by Zikmund-Fisher and colleagues shows how an individual person’s risk compares against the average risk. This particular individual has significantly elevated risk of breast cancer, roughly 11%, far beyond the ‘average’ risk of 1.7%.

We thought social comparison could help bring perception of risk in line with clinical realities, because people tend to underestimate the risks associated with hypertension.

Our hypothesis for this is straightforward – social comparison framing increases perception of risk

We ended up with case studies for three versions of risk communication, a no information control, verbal risk information, and social comparison, which was crossed with our three blood pressure levels of controlled blood pressure, low uncontrolled hypertension, and high uncontrolled hypertension.

An example of a sample vignette is here, we see a stoplight display with a graph showing the blood pressure data – this is what patient’s see when viewing their blood pressure at home.

The blue segment of the bar indicates the target range for systolic blood pressure, and the tan segment indicates the target range for diastolic blood pressure.

The verbal description states that “your risk of heart attack and stroke in the next 10 years based on your blood pressure is 3% which means that 3 out of 100 people with your average blood pressure will have a heart attack or stroke in the next 10 years”.

Finally, in the social comparison condition, the first sentence is the same (e.g., your risk of heart attack and stroke etc.), but we add relative risk information, in this case, “your risk is at the average risk compared to people in the normal range, which is 3%”.

In contrast, this is the case where hypertension is NOT controlled.

These are the differences, first, the stoplight indicator clearly shows ‘yellow’ instead of green. We can also see that both diastolic and systolic blood pressure are far outside the ‘ideal range’ marked by the blue and tan shaded areas.

The verbal description shows a percentage estimate of 5%, instead of 3%.

And the social comparison condition notes that the risk of 5% is above the normal range of 3%.

Briefly, for this study, our participants were recruited from Qualtrics and paid for their participation. The participants were drawn from a national U.S. Sample of patients who have been previously diagnosed with hypertension – our participants were mostly older, with an average age of 70, mostly female, and primarily white, with the majority having at least some college education.

Looking at our measures - risk perception was graded on a likert scale from 1-10, representing likelihood of heart attack/stroke in the next 10 years

Orienting to the graph, the x-axis shows different levels of hypertension, the y axis shows perceived risk of heart attack and stroke, and the different colors show our different risk communication strategies

We saw a significant interaction between levels of hypertension and risk communication conditions. Perception of risk was highest for participants in our control condition – the orange bar, whereas perception of risk was lowest for participants given verbal risk information – the green bar, in cases of high uncontrolled hypertension.

Preferred response was assessed under 6 categories, doing nothing, just talking to the doctor at the next appointment, asking to see the doctor at the first available appointment, going to a hospital or doctor tomorrow, going to a hospital when convenient today, or go to a hospital immediately.

For discussion and analysis, we batched these six responses into three categories that represent groups of behavioral tendencies. The first two responses (nothing/next appointment) batch neatly into a ‘doing nothing’ category, the next two responses (ask for doctor at first available appointment, going to doctor tomorrow) can be batched as ‘doing something’, and the last two categories (going to a hospital when convenient today, or go to a hospital immediately) can be batched as ‘doing something immediately’.

The control condition is shaded in tan, the social comparison condition is shaded in green, and the verbal condition is shaded in orange. Responses across colors aggregate to 100%.

Across the two factors of type of response and condition, a chi-squared test of independence indicates that none of our differences were statistically significant.

Our next study wanted to analyze the effects of part-to-whole graphical communication on risk perception and behavior in the context of hypertension judgement

Much like our work with social comparison, it is well known that part-to-whole graphic representation tends to improve relative ratio understanding, which should lead to improved precision around risk perception. Given that people tend to underestimate the risks associated with hypertension, we thought that this would be an appropriate response.

For example, we can see in this example of part-to-whole graphics designed by Zikmund-Fisher and colleagues, that the shaded areas clearly indicate the increased additional risk of side effects from taking the drug, tamoxifen.

Our hypothesis for this is straightforward – that Part-to-Whole graphic representation will result in more accurate perception of risk.

Similarly to study 1, study 2 was a 3x3 design, where systolic BP mean was crossed against our verbal, icon, or bar risk communication strategies, resulting in 9 different displays.

An example of a sample vignette for controlled blood pressure is here. We see a stoplight display with a graph showing the blood pressure data – this first case for Study 2 is actually the same as the ‘verbal description’ case used in Study 1; which primarily provides a verbal description of percentage of risk.

The Icon array shows the exact same information but provides an additional part-to-whole visualization using shaded in icons, showing proportional representation of risk per hypothetical 100 individuals.

Finally, the horizontal bar shows this information using the relative proportions of space, as well as color-based delineation for risk.

In contrast, this is the case where hypertension is NOT controlled.

As in Study 1, the stoplight indicator clearly shows ‘yellow’ instead of green. We can also see that both diastolic and systolic blood pressure are far outside the ‘ideal range’ marked by the blue and tan shaded areas.

The verbal description shows a percentage estimate of 5%, instead of 3%.

Likewise – the icon array indicates this additional due to uncontrolled hypertension by shading in two additional icons in red – showing a proportional representation of the 2% increase in risk to 5%.

The horizontal bar shows this exact same information, with the addition of a blue shaded section with size calibrated to it’s proportional increase of again, 2% over standard hypertension risk.

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Similar to study 1, our participants were recruited from Qualtrics and paid for their participation. The participants were drawn from a national U.S. Sample of patients who have been previously diagnosed with hypertension – our participants were mostly older, with an average age of 60, mostly female, and primarily white, with the majority having at least some college education.

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Risk perception was graded on a likert scale from 1-10, representing likelihood of heart attack/stroke in the next 10 years – the same way as in study 1

While there were significant differences in risk perception as a result of blood pressure level, there were no significant interactions between condition and blood pressure mean.

Preferred response was likewise measured and batched the same way as in Study 1

The verbal condition is shaded in tan, the bar condition is shaded in green, and the icon condition is shaded in orange. Responses across colors again aggregate to 100%.

Across the two factors of type of response and condition, a chi-squared test of independence indicates that none of our differences were statistically significant.

Moving on to the discussion – while it is not a revolutionary result, it is good to see that risk perception and preferred response are sensitive to mean blood pressure, which is clinically appropriate. Furthermore, when comparing our risk communication strategies with each other, we find that at least when comparing an uninformative control against a more sophisticated verbal risk condition, subjects to have a lower, but more accurate perception of risk in cases of uncontrolled hypertension.

Wrapping up – we began with a sobering look at the global crisis of uncontrolled hypertension, while I don’t believe our work on risk perception is a one-stop shop solution, our improved methods of communication directly addresses clinical uncertainty – and thus should lead to improved decision making for both patients and care providers, leading to better healthcare outcomes overall.